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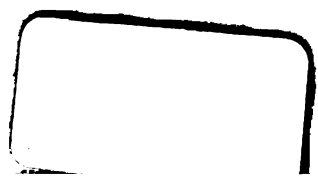
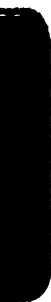
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SIXTEENTH ANNUAL REPORT

OF THE

BOARD OF TRUSTEES

OF

WATER WORKS,

TO THE

COUNCIL OF THE CITY OF CLEVELAND,

TOGETHER WITH THE

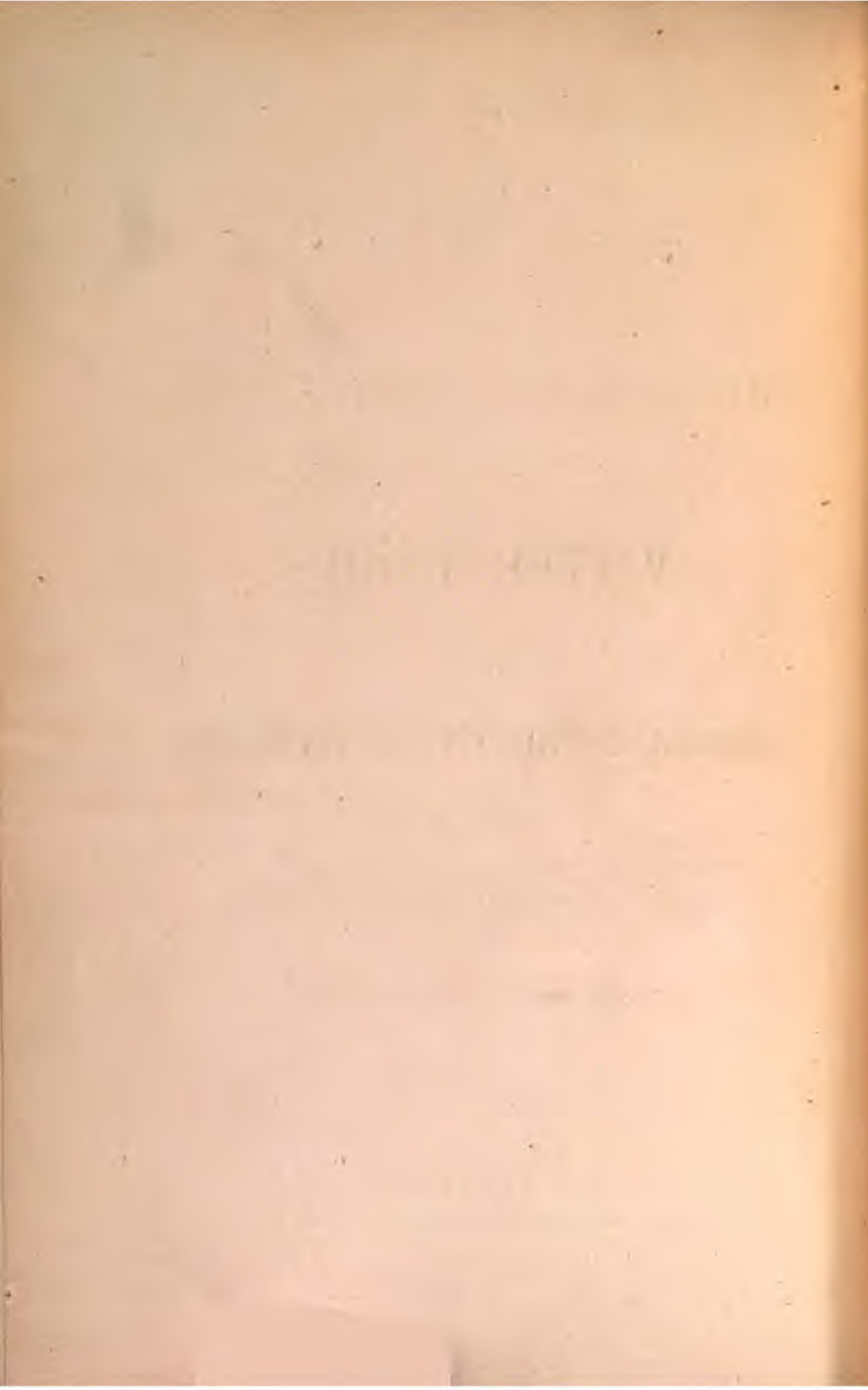
REPORTS OF THE OFFICERS OF THE BOARD,

FOR THE YEAR 1872.

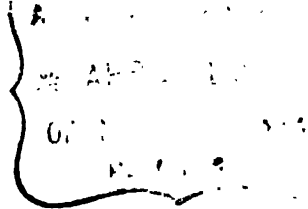
CLEVELAND, OHIO:

WARCHTER AM ERIE PRINTING COMPANY, 77 MICHIGAN STREET.

1872.



M. W. Kingsley



SIXTEENTH ANNUAL REPORT  
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OF  
WATER WORKS,  
TO THE  
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REPORTS OF THE OFFICERS OF THE BOARD,  
FOR THE YEAR 187~~2~~<sup>1</sup>

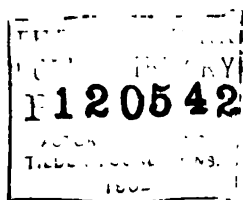
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CLEVELAND, OHIO:

WRIGHTER AND ERIE PRINTING COMPANY, 77 MICHIGAN STREET.

1872.  
DUP. EXCH. '9 JULY 1882  
AM. SOC. CIV. ENG.  
FOLD COLL'N

YDLA



# REPORT

OF THE

## TRUSTEES OF WATER WORKS.

April 1st, 1872.

*To the Honorable City Council of the City of Cleveland:*

GENTLEMEN :—The undersigned herewith submit the Sixteenth annual report of the Trustees of Water Works.

In the reports of the Superintendent and Engineer and the Secretary will be found statements in detail of the amount of work done, the general condition of the works and their cost to December 31st, 1871.

A new pumping engine is being built by the Cuyahoga Furnace Company of this city, of a daily capacity of eight million gallons, to meet the increasing demand for water. The engine we expect will be completed and in running order sometime during the Fall.

Plans are being prepared and nearly completed for the engine and boiler-house, and the work of construction will be commenced as soon as the weather will permit. A contract has also been made with Mr. SILAS MERCHANT, of this city, for a new pumping main, three feet in diameter, to run from the new pumping works to the reservoir. In erecting the new building and laying the new pumping main, provision will be made for a second engine, to be placed in the building as soon as the demand for water shall require it, the only expense then necessary to double the pumping power will be the cost of the engine and boilers.



On account of unforeseen and unexpected difficulties, the progress in the tunnel has not been as great as was anticipated at the time of our last report, but if no further delays should occur, the work will be completed before the end of the year. For particulars as to progress and cost of the work we would refer you to the reports of the Superintendent and Engineer and the Secretary of Water Works, which we herewith present.

Respectfully submitted,

E. M. PECK,  
A. K. SPENCER, } Trustees.

Office of Water Works, April 1st, 1872.

# REPORT

OF THE

## SECRETARY OF WATER WORKS.

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OFFICE OF THE WATER WORKS, }  
CLEVELAND, January 1, 1872. }

*To the Trustees of the Water Works:*

GENTLEMEN: The following is an abstract of the cash account of the Receipts and Disbursements of this Department for the year 1871:

### RECEIPTS.

For water, including permits.....	\$80,487 44
For Water Bonds sold.....	100,618 36
For interest on deposits.....	940 02
From city, to lay water pipe.....	6,952 21
Cash on hand at time of last statement.....	24,696 59
Total.....	<u>\$213,694 62</u>

### DISBURSEMENTS.

For running expenses.....	\$24,382 16
For repairs.....	10,155 33
For pipe extension.....	66,532 25
For construction (purchase of land &c.).....	8,298 32
For inlet extension.....	3,114 89
For lake crib.....	39,869 11
For lake shaft.....	3,696 27
For lake tunnel.....	31,645 70
For new pumping engine, on account.....	7,000 00
Cash in office and on deposit.....	18,921 83
Cash in City Treasury.....	78 76
Total.....	<u>\$213,694 62</u>

For a detailed statement of the disbursements reference may be had to the report of the Superintendent and Engineer.

LEDGER BALANCES DECEMBER 31, 1871.

	Dr.	Cr.
Water rent . . . . .		\$303,030 62
Interest and discount . . . . .		3,495 58
City of Cleveland . . . . .		40,074 84
Bonds . . . . .		835,000 00
Cash . . . . .	\$19,000 59	
Construction . . . . .	950,438 83	
Lake crib . . . . .	105,149 09	
Lake tunnel . . . . .	72,663 04	
Lake shaft . . . . .	10,308 69	
Lake shore shaft . . . . .	7,678 06	
Inlet extension . . . . .	9,362 74	
New engine . . . . .	7,000 00	
	<hr/>	<hr/>
	\$1,181,601 04	\$1,181,601 04

The construction account amounting to \$950,438 83 is the cost of the Water Works, excepting the lake tunnel work and new engine now being constructed. There has been expended on the lake tunnel work the sum of \$205,161 62.

The account of water rent shows the earnings of the Water Works over operating expenses and repairs since the construction of the work.

The following table exhibits the receipts for water and the expenditures for running expenses and repairs from the time of the introduction of lake water into the city until the present time; also the earnings after deducting such expenditures:

YEARS.	Receipts for Water.	Running Expenses.	Repairs.	Receipts, less run- ning ex- penses and repairs.
1856 to 1859 inclusive.	\$34,528 73	\$29,845 49	\$2,996 08	\$1,687 16
1860.....	16,793 60	7,683 80	1,734 38	7,375 42
1861.....	17,097 85	7,768 36	1,350 84	7,978 65
1862.....	22,730 53	8,086 19	1,291 29	13,353 05
1863.....	23,421 30	10,011 96	835 54	12,573 80
1864.....	33,389 49	13,573 26	1,953 49	17,862 74
1865.....	40,888 01	17,346 56	1,382 21	22,159 24
1866.....	45,363 70	14,277 13	8,818 77	22,267 80
1867.....	51,862 45	14,246 06	3,685 79	33,930 60
1868.....	57,297 98	17,304 32	3,653 43	36,340 23
1869.....	62,869 72	18,880 13	3,299 56	40,690 03
1870.....	70,411 18	19,725 24	9,823 99	40,861 95
1871.....	80,487 44	24,382 16	10,155 33	45,949 95
Totals.....	\$557,141 98	\$203,130 66	\$ 50,980 70	\$303,030 62

It will be seen by reference to this table, that the receipts for water for the year 1871 are in excess of the year 1870 the sum of \$10,076 26.

### BONDS.

The funded debt of the city for Water Works' purposes is as follows:

Seven per cent. bonds, due January 1, 1879.....	\$400,000
“ “ “ “ “ “ 1, 1881.....	100,000
“ “ “ “ “ “ 1, 1884.....	210,000
“ “ “ “ “ “ October 1, 1880.....	75,000
Six “ “ “ “ “ “ July 1, 1878.....	25,000
“ “ “ “ “ “ 1, 1879.....	25,000

Total.....\$835,000

There remains unsold of the last issue of bonds \$90,000.

The sinking fund, under the control of the Sinking Fund Commissioners, is pledged for the payment of the Water Works' bonds, which fund, it is believed, will be sufficient to pay the bonds at the time of their maturity.

The interest on the Water Works bonds is paid by the city from a tax levied for that purpose.

Respectfully submitted.

H. C. HAWKINS,  
Secretary.



SIXTEENTH ANNUAL REPORT  
OF THE  
SUPERINTENDENT AND ENGINEER  
OF THE  
**Cleveland Water Works.**

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*To the Board of Trustees of Water Works:*

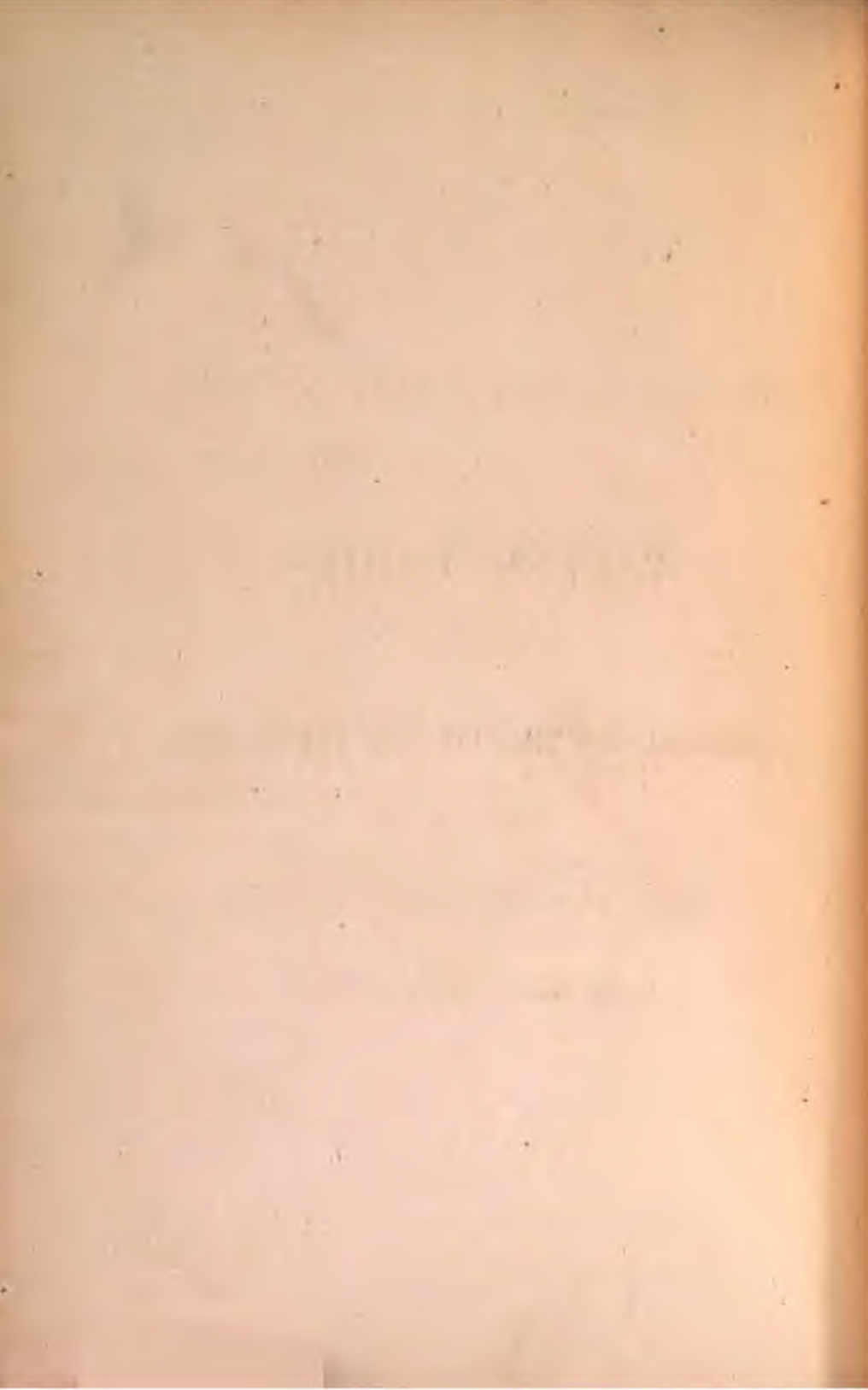
GENTLEMEN.—I herewith submit the Sixteenth Annual Report upon the condition of the Cleveland Water Works.

The general condition of the works was never better than at the present time.

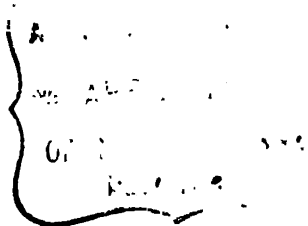
The aqueduct through which the supply of water is now taken, was found to be so nearly filled with sand and sedementary matter in the early fall when the water in the lake commenced to lower, that only one of the engines could be kept working, and, at times when a strong wind was blowing off land, it could not be worked at full speed. Preparations were immediately made for cleaning the aqueduct, and the work is now so far advanced that there is an abundant supply of water for both engines, even at the low stage of water now prevailing, and hopes are entertained that the work will be completed before the end of January.

LAKE TUNNEL.

The length of tunnel completed from the shore end was, on the 29th of April, three thousand nine hundred and fifty-two (3,952) feet, being an advance of one thousand two hundred and forty-two feet in four months; but on the evening of that day, gas was discovered coming through the wall of the



M. W. Kingsley



SIXTEENTH ANNUAL REPORT  
OF THE  
BOARD OF TRUSTEES  
OF  
WATER WORKS,  
TO THE  
COUNCIL OF THE CITY OF CLEVELAND,  
TOGETHER WITH THE  
REPORTS OF THE OFFICERS OF THE BOARD,  
FOR THE YEAR 1872.1



CLEVELAND, OHIO:

WAGHTER AND ERIE PRINTING COMPANY, 77 MICHIGAN STREET.

DUP. EXCH. '8 JULY 1872.  
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FIELD COLL'N

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ing from about five feet above the surface of the water to thirteen feet below.

The stone thrown around the outside of the crib had the desired effect, preventing any further settlement than was reported last year.

The expenditures for the past year upon the tunnel and crib with the total expenditure to the 31st day of December, 1871, will be found on another page.

The work upon the crib has all been done under the superintendence of Mr. JOHN CARNEGIE, who also designed the superstructure. The work under his charge has been carried out in a highly satisfactory manner.

The Chief Engineer of the pumping works reports as follows:

“WATER WORKS ENGINE HOUSE,  
January 1, 1872.”

*“To the Trustees of Water Works:*

GENTLEMEN:—In accordance with the duty devolving upon me, I herewith submit a report upon the condition of the pumping machinery of the Water Works, with the amount of work done, and the repairs and improvements made during the past year.

The west engine was stopped on two occasions, first on the 7th day of January by the valve stem of the exhaust valve becoming disconnected from the valve.

Second, on the 29th day of March by the fracturing of a gib and breaking of a key in the pump connection of the main cap.

The east engine was stopped on three occasions, first on the 19th day of February, for the purpose of disconnecting the stop valve chamber of the west main pump from the stand pipe, and putting on a blank flange, or bonnet, on the stand pipe branch, so that the east pump could be used while the west pump was undergoing repairs and improvements in putting in a new and improved stop valve chamber, and discharge pipe.

Second, on the 12th day of March, for the purpose of fitting the discharge pipe flanges connecting the new stop valve chamber with the stand pipe.

Third, on the 19th day of March, for the purpose of completing the connection between the new stop-valve chamber and the stand pipe.

During the time the repairs on the west pump were being made—being 29 days—the east engine alone was relied upon and was worked about nineteen hours per day.

On the 26th day of March the west engine was again started, with the new stop-valve of new construction and an improved valve-seat and valve in the lower chamber of the main pump. Both improvements are giving perfect satisfaction.

Duplicates of both stop-valve and induction valve have been made for the east main pump, and will be put in place as soon as the engine can be stopped for that purpose.

There has been an uninterrupted supply of water throughout the year, but on two occasions the head of water in the reservoir was considerably lowered; first in May, for the purpose of cleaning the reservoir, the water was lowered to 12 feet for nine days; and again during the months of November and December the engines were stopped from one to three days a week, for the purpose of cleaning the aqueduct leading from the lake to the pump wells. During this time the depth of water in the reservoir varied from twenty to twelve feet.

The average depth in the reservoir for the year was eighteen and three-tenths feet.

The engines worked during the year 460 days, the average running time per day being eighteen hours and forty-eight minutes, a per diem increase of seven minutes and an increase of ninety-eight days.

Number of strokes made by east engine.....	2,155,900
“ “ “ west “ .....	2,104,600

Total number of strokes.....	4,260,500
------------------------------	-----------

Average height above surface of lake to which water was pumped, 157 <sup>78</sup>/<sub>100</sub> feet.

Duty of the east engine.....	40,449,634
“ “ west “ .....	41,690,224

pounds of water raised one foot high with each one hundred pounds of coal consumed, the coal used being common bituminous slack.

The following are the repairs and improvements made during the year:

Repaired the exhaust valve stem, valve and lever of west engine.

Put a new stop valve chamber, stop valve and discharge pipes, between the west main pump and stand pipe.

Put a new valve and valve seat in the lower chamber of the west main pump.

Put new set of gibs and keys in the main pump cap connections of both engines.

Gearing of new construction has been fitted to the gearing of both engines for the purpose of working them together when required. This arrangement giving perfect satisfaction.

Both engines may be worked together as if constituting one machine, and either of them may be stopped at any time without interfering in the least with the working of the other.

When both engines are working together, a constant stream of water is passing from the pump into the discharging main pipe, and the pulsation of the pumps through the main is almost entirely destroyed.

Put a new rubber valve in the air pump piston of each engine.

Put a new pump valve in the upper chamber of the east main pump.

Removed some braces of No. 3 east boiler for the removal of scales and replaced the same.

Rebuilt part of the front brick walls of the east boilers

Attached three  $1\frac{1}{2}$  inch brass cocks, with iron branch to the stand pipe, for water connections with both cold water cisterns and for hose connections, also one  $\frac{3}{4}$  inch hose connection.

Attached  $\frac{3}{4}$  inch brass cocks to the feed pipes of both sets of boilers, for the purpose of making water connection with the stand pipe through hose when required.

At noon on the 7th day of July, the soot in the flue between the boilers and smoke pipe took fire and overheated the smoke-pipe, and damaged it about fifteen feet above the stone base so as to render it unsafe. After some consideration it was thought best to build a brick chimney outside of the pipe. The stone base was examined and pronounced safe and suitable as a foundation on which to build a brick chimney shaft.

The upper stone on the base was removed, and the recess between the walls filled in with brick and stone mortar, the stone reset, and the brick work for a substantial chimney com-

menced. In carrying up the brick work, flat segment iron bars with forged hooks were built in the brick work for supporting the pipe at each alternate course of the pipe plate, to prevent it from settling down and forming any obstruction to the draft.

Cast iron segments were also placed under the lateral braces of the pipe and under the flanges of the union between the old and new pieces of pipe and built into the brick work.

The brick work was carried up about four feet above the flange connection, and finished with a cast-iron cap provided with cast-iron drops.

The fractured stop valve chamber of the east main pump is in somewhat worse condition than at the time of my last report.

The cold water cisterns and wood floors below valve gearing need renewing, as soon as the engines can be stopped for that purpose.

Some slight repairs are also necessary on the details of engines and boilers.

The front brick wall of the west boilers needs to be partly rebuilt, in all other respects the engines and boilers are in good working condition.

#### NEW BOILERS OF THE CORNISH CLASS.

The drawings made for the new boilers, brick-work boiler foundations, drain pit and pipes of the old engines will answer for the arrangement of the boilers etc. for the new engines, if the boiler flues can be made with flanged joints and stiffened with rings so as to stand a steam pressure of fifty pounds per square inch. This kind of boiler is believed to be most suitable for both old and new engines.

The boilers for the new engines will be the first needed.

I shall soon be ready to submit to you for your consideration and approval completed plans for these boilers.

The annexed schedule A. gives the record of the engines for the year 1871.

All of which is respectfully submitted,

JOHN VIAL,  
Engineer in charge."

#### ENLARGEMENT OF WORKS.

Land upon which to build new pumping works has been purchased directly south of the present works. A contract for a pair of compound duplex pumping engines, having a daily capacity of eight million gallons, has been made with the Cuyahoga Steam Furnace Co., of this city, to be completed by the 1st of June, or as soon thereafter as the foundation and a suitable building can be made ready for their reception.

The contract price for the engine placed in the building, not including boilers, steam pipes or any part of the foundation, is \$52,500. Plans are being prepared for an engine and boiler house large enough to contain two engines and sets of boilers of the same size. The foundation for the second engine and boilers, with a second pump well, will be built at the same time.

A contract has also been made with MR. SILAS MERCHANT, of this city, for a new pumping main pipe, three feet in diameter, to be laid from the new works to the reservoir, a distance of about two thousand three hundred feet.

It is proposed to connect this pipe with the present pumping main, so that in case of accident to one of them, either of the pumps may discharge water into the reservoir through the other. Plans have also been made for connecting the new pumping main with the present inlet pipe to the reservoir, as well as with the distributing mains. By this arrangement the risk of making a new entrance into the reservoir will be avoided and the same purpose accomplished.

#### RESERVOIR AND GROUNDS.

The reservoir was cleaned early in the Spring, and slight repairs made in the brick lining at the water line. More extensive repairs to the brick work will be necessary during the coming year, and I would again recommend the substitution of stone flagging or paving at the water-line for the brick now used. The turf, trees, walks and grounds, have been well attended to by the keeper and are in good condition. The bridges leading from the embankment to the stop valve shafts, are badly decayed and will soon need rebuilding. When the work is done, good substantial iron bridges should be built. The fence on the Franklin Street front is beginning to have a shabby ap-

pearance, and should be taken down to give place to a neat stone and iron structure, that it may be in keeping with improvements, being made by the residents of that street in the vicinity of the reservoir.

The railing on top of the embankment should also be repaired to correspond with the other improvements.

#### DISTRIBUTION.

For the last two years the pressure of water in the pipes in the eastern part of the city has been gradually decreasing, so much so, that in the third stories, and in many cases in the second stories of dwellings in the higher portions of that district, the water will not run for several hours during the middle of the day. This weak pressure is the result of the increased use of water on account of the rapid extension of pipe, without a corresponding increase in the extension of supply mains for feeding these distributing pipes. This weak pressure can only be remedied by the laying of another supply main from the reservoir to the eastern part of the city, and in the meantime the pressure must continue to grow weaker until a new pipe is laid. I would therefore call your attention to the necessity of taking such action, at an early day, as will result in affording a liberal supply of water for that portion of the city, so that upon the completion of the new pumping works all parts of the city may have an abundant supply. In anticipation of some action to this end on your part, I have given the subject a good deal of consideration, and have come to the conclusion, that a pipe, of not less than thirty inches diameter, should be laid from the reservoir to Erie street at least, to be extended eventually to Wilson Avenue.

The extension of local distributing pipes must necessarily be limited in those portions of the city where the supply is weak, until this new supply main is laid.

The annexed schedules give all the information necessary to afford a full knowledge of the work done and extensions made to the works during the past year.

The number and size of new service pipe connections, made with the mains during the past year, is as follows:

1 inch.....	6
2 ".....	10
4 ".....	724
Total.....	740

The total number of connections made with the main pipes to January 1st, 1872, was 4,633.

The number of each size was as follows:

4 inch.....	7
3 ".....	10
2 ".....	29
1½ ".....	11
1 ".....	91
¾ ".....	233
4 ".....	4,252
Total.....	4,633

The expenses for the year, as shown by vouchers in this office, have been as follows:

#### RUNNING EXPENSES FOR 1871.

Pay-Rolls for 12 months, (labor).....	\$15,416 78
Coal.....	5,923 27
Surveying Instruments.....	359 20
Brass Work.....	407 60
Oil.....	350 55
Traveling and Car Fare.....	308 06
Printing.....	276 17
Damages.....	200 00
Iron Work.....	189 33
Rent of Store Room.....	150 00
Stationery, Postage and Revenue Stamps.....	148 76
Mutton Tallow.....	129 26
Plumbing.....	119 64
Crab winch.....	100 00
Cotton Waste.....	72 00
Hemp Packing.....	69 52
Hardware and Lamps.....	48 07
Cartage, Express and Freight.....	31 64
Fire Brick and Clay.....	26 00

Recording Deeds and Examining Records.....	\$15 00
Leather Hose.....	13 50
Soap.....	12 83
White and Red Lead.....	11 56
Sundries.....	13 42
	<hr/>
	24,392 16
Received for sundries .....	10 00
	<hr/>
Total.....	\$24,382 16

PIPE EXTENSION, 1871.

Pay Rolls for 12 months (labor).....	\$ 9,696 10
Cast Iron Pipe and Special Castings.....	49,194 77
Lead.....	3,240 76
Valves .....	2,360 00
Meters.....	693 50
Cartage.....	468 18
Blacksmithing.....	303 06
Hemp Packing.....	192 76
Plumbing.....	176 20
Coal.....	95 71
Carpenter Work, Lumber and Wood Plugs.....	77 85
Brass Work.....	79 50
Paving.....	62 30
Hardware.....	9 40
Printing.....	7 50
Fire Clay.....	4 50
Sundries.....	5 52
	<hr/>
	66,667 61
Received for sundries.....	158 31
	<hr/>
Total.....	\$66,509 30



# REPAIRS 1871.

Pay Rolls.....	\$3,820 27
Labor .....	99 75
Blacksmithing, Hardware and Iron Work.....	1,501 55
Sundries, Twine, Etc.....	46 58
Cement.....	39 25
Carpenter Work.....	258 28
Lumber.....	270 13
Cartage.....	159 50
Rope, Blocks, Etc.....	201 58
Pig Lead.....	137 16
White Lead, Etc.....	15 75
Brass Work.....	16 75
Paving.....	316 09
Mason Work and Material.....	757 30
Rubber Valves and Rings.....	168 60
Towing and Boat Hire.....	64 00
Rubber Coats and Boots.....	40 80
Engine and Boiler.....	500 00
Valve.....	1,900 00
Coal.....	20 75
Plumbing.....	133 88
	<hr/>
	10,467 77
Received for sundries.....	320 72
	<hr/>
Total....	\$10,147 05

## INLET EXTENSION.

Pay Rolls.....	\$1,067 25
Consulting Engineer.....	1,500 00
Driving Pipe.....	379 27
Wrought Iron Pipe.....	90 86
Freight.....	35 00
Blacksmithing.....	5 70
Rope and Blocks.....	8 37
Calking.....	4 13
Castings.....	4 51
Cartage.....	4 50
Hardware.....	2 30
Miscellaneous.....	13 00
	<hr/>
	3,114 89
Expended previous to 1871.....	6,247 85
	<hr/>
Total Expenditure.....	\$9,362 74

LAKE SHAFT.

Paid A. A. McDonell, contractor.....	\$11,705 96
Expended previous to 1871.....	6,612 42
Total Expenditure to Dec. 31st, 1871.....	18,318 38

LAKE TUNNEL.

Paid A. A. McDonell, contractor.....	\$22,212 48
Iron Work.....	103 62
Towing and Boat Hire.....	111 64
Labor.....	12 00
	22,439 74
Expended previous to 1871.....	41,017 34
Total.....	\$63,457 08

LAKE CRIB.

Pay Rolls.....	\$7,104 24
Towing and Boat Hire.....	2,382 86
Stone.....	8,580 00
Blacksmithing and Hardware.....	2,022 45
Submarine Diver.....	1,593 00
Lumber.....	1,306 75
Cement and Lake Sand.....	1,084 72
Roofing and Galvanized Iron Work.....	883 18
Rope, Blocks, Etc.....	79 55
Glass and Glazing.....	62 16
Dock Rent.....	25 00
Oil and Lamps.....	21 15
Cartage.....	9 15
Sundries.....	56 52
	25,210 73
Expended previous to 1871.....	79,947 10
Total.....	\$105,157 83

There are on hand and stored on the Engine House lot, two wrought-iron cylinders, that were procured for the Lake Shaft, but not used, but which can be used in the shafts for the land tunnel. Their cost was..... \$1,196 27

Respectfully submitted,

JOHN WHITELAW,

Superintendent and Engineer.

## SCHEDULE A. ENGINE RECORDS FOR 1871. EAST ENGINE.

Months.	Days.	Pumping.			Coal consumed.			Gallons of water pumped.	Height.		Duty.
		hrs.	m.	Strokes	Raising steam.	Pumping.	Total.		ft.	dec.	
January...	15	305	25	153,975	2,400	150,300	152,000	49,425,975	157,955		42,782 654
February...	18	383	25	188,325	2,400	196,300	198,000	60,452,325	158,333		40,305 134
March.....	28	557	25	275,575	2,000	281,800	283,800	88,459,575	157,765		41,121 890
April.....	8	162	25	78,350	.....	80,000	80,000	25,150,350	157,197		41,324 079
May.....	20	400	10	198,850	2,400	198,000	200,400	63,880,850	157,210		41,850 790
June.....	25	382	25	177,200	1,000	194,300	195,300	56,881,800	157,556		38,390 208
July.....	23	377	50	175,800	2,400	178,200	180,000	56,431,800	157,376		41,121 886
August.....	28	510	15	289,850	.....	257,800	257,800	76,991,850	157,592		39,355 041
September	20	371	15	184,725	1,000	197,000	198,000	56,296,725	157,600		39,348 578
October.....	10	188	35	96,550	.....	94,800	94,800	30,992,550	157,983		43,188 879
November	17	316	15	155,800	10,000	157,300	167,800	49,851,300	158,124		39,284 153
December	24	459	35	231,400	400	247,000	247,000	74,279,400	158,782		39,865 332
T'ls & av.	290	4415	00	2 155 900	24,000	2 233 000	2 257,000	692,044,500	157,739		40,449 634

## WEST ENGINE.

January...	17	339	55	173,300	2,400	170,800	173,000	55,629,300	158,112		42,515,343
February...	10	221	05	111,875	.....	111,000	111,000	35,911,875	158,341		42,809,146
March.....	4	05	40	31,375	5,000	34,400	39,400	10,071,375	157,194		35,601,283
April.....	22	435	25	222,125	2,400	217,200	219,000	71,302,125	157,223		42,668,797
May.....	17	321	50	159,525	0,800	161,300	168,000	51,307,525	157,260		40,084,944
June.....	28	403	00	224,175	1,000	225,000	226,000	71,903,175	157,371		41,902,099
July.....	25	456	10	229,625	2,400	216,300	218,600	71,462,625	157,359		43,018,565
August.....	24	392	50	181,175	.....	199,400	199,400	58,157,175	157,701		38,463,638
September	21	378	25	187,250	4,800	195,800	200,600	60,107,250	157,591		39,485,931
October.....	24	514	50	271,050	.....	252,800	252,800	87,007,050	158,304		45,334,067
November	17	343	25	173,475	5,000	168,000	174,300	56,327,475	158,255		42,761,954
December	15	301	00	144,650	8,300	147,300	155,400	40,432,650	158,736		39,667,962
T'ls & av.	221	4233	35	2 104 630	38,600	2 099 400	2 138,000	675,576,600	157,773		41,080,221

## BOTH ENGINES.

T'ls & av.	409	8648	35	4 260 500	63,200	4 332 400	4,395,000	1 367 621 100	157,781		41,108,940
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**TOTALS AND AVERAGES FOR BOTH ENGINES FOR EACH YEAR SINCE CONSTRUCTIONS OF WORKS.**

Years.	Pumping		Strokes.	Coal consumed.			Gallons of water pumped.	Height.		Duty.
	hrs.	m.		Raising steam.	Pumping.	Total.		ft.	dec.	
1857.....	1,200	25	399,894	226,300	407,325	633,525	127,292,365	158,000		
1858.....	1,154	55	446,724	232,050	430,225	662,275	142,155,434	156,533		31,453,825
1859.....	1,413	00	625,755	233,050	549,600	782,650	198,234,090	155,927		35,697,332
1860.....	1,811	05	818,303	298,730	707,950	706,500	260,230,354	156,466		35,206,000
1861.....	2,107	35	1,013,129	365,600	854,159	1,118,759	322,175,092	156,432		37,548,089
1862.....	2,347	05	1,162,094	376,846	1,113,127	1,291,978	369,673,092	156,337		34,730,024
1863.....	2,500	10	1,310,875	281,903	1,109,418	1,531,321	430,790,875	156,690		35,535,438
1864.....	2,848	10	1,483,225	274,744	1,445,568	1,730,392	476,114,225	157,013		36,410,146
1865.....	3,971	40	1,611,495	286,950	1,579,559	1,866,509	517,201,005	158,017		36,621,770
1866.....	3,521	35	1,828,830	276,800	1,925,400	2,202,200	587,372,230	157,791		35,394,587
1867.....	3,870	10	2,169,375	270,200	2,162,400	2,432,600	696,399,375	157,439		37,685,498
1868.....	4,503	13	2,394,975	198,100	2,078,600	2,276,700	768,756,975	157,822		44,364,421
1869.....	5,673	09	2,801,425	70,000	2,585,000	2,655,000	898,936,425	157,566		44,597,144
1870.....	6,352	20	3,508,500	49,000	3,388,300	3,437,300	1,126,228,500	156,970		43,010,629
1871.....	8,648	35	4,290,500	63,200	4,332,400	4,395,600	1,367,621,100	157,781		41,108,940

### SCHEDULE B.

SHOWING THE DISTRIBUTION OF WATER FOR EACH MONTH IN 1871.

MONTH.	GALLONS DISTRIBUTED.			
	Per month.	Av. per day.	Ea. inh. per day.	Ea. con'r per day.
January .....	105,055,275	3,388,880	32.27	112.96
February .....	96,364,200	3,441,579	32.78	114.72
March .....	98,530,950	3,178,418	30.27	102.61
April .....	96,452,475	3,215,068	30.62	107.17
May .....	115,098,375	3,710,915	35.34	123.70
June .....	128,841,975	4,294,733	40.90	143.16
July .....	127,894,425	4,125,627	39.29	137.52
August .....	135,149,025	4,359,646	41.52	145.32
September .....	119,408,975	3,980,132	37.91	132.67
October .....	117,990,800	3,806,439	36.25	126.88
November .....	106,178,775	3,505,959	34.34	116.96
December .....	120,712,050	3,893,937	37.08	129.80
Total and average .....	1,367,621,100	3,746,907	35.68	124.90

### TOTALS AND AVERAGES FOR EACH YEAR SINCE COMPLETION OF WORKS.

YEAR.	GALLONS DISTRIBUTED.				PER CENT. OF INCREASE
	Per year.	Average per day.	Ea. inh. per day.	Ea. con'r per day.	
1857 .....	127,262,265	348,664	7.75	110.68	
1858 .....	142,155,434	389,497	8.37	93.44	11.70
1859 .....	198,234,090	513,107	11.31	91.27	39.45
1860 .....	260,230,354	710,984	14.11	101.57	31.87
1861 .....	322,175,022	881,569	16.32	114.50	23.81
1862 .....	369,673,092	1,012,704	19.47	120.57	14.74
1863 .....	420,700,875	1,152,857	20.97	117.54	12.83
1864 .....	476,114,225	1,300,858	21.68	123.89	12.14
1865 .....	517,361,005	1,417,153	21.80	122.70	8.64
1866 .....	587,372,220	1,609,239	22.35	124.26	13.55
1867 .....	686,369,375	1,907,861	23.85	115.98	18.55
1868 .....	768,786,975	2,106,265	24.77	116.08	10.40
1869 .....	948,936,425	2,462,839	27.89	120.20	16.92
1870 .....	1,126,228,500	3,085,558	30.86	113.20	25.28
1871 .....	1,367,621,100	3,746,907	35.68	124.90	21.43

## SCHEDULE, SHOWING EXTENSION OF WATER PIPE IN 1871.

DIAM. PIPE INCH'S	STREET.	BETWEEN WHAT POINTS.	FEET PIPE LAID	TOTAL.	REMARKS.
12	Franklin	Reservoir to Courtland	3,100	3,100	
10	Prospect	In Kennard st.	5		
8	Pittsburgh	R. B. Crossing to Canal st.	1,090	5	
8	Case av.	Prospect to Garden	4,064		
8	Prospect	Kennard st. east	577		
8	Lorain	Courtland to Waverly	558		
8	Centre	Main to N. of Spruce	416		
8	Waverly	Across Lorain	66		Relaid all but 12 ft.
				6,701	
6	Lake	Brownell to Alabama	3,780		
6	Woodland av.	Cemetery to Workhouse	2,132		
6	Dodge	Lake to 60 feet N. of St. Clair	539		Relaid.
6	Forest	Woodland south	2,356		
6	Garden	Perry to Forest	3,657		
6	Longwood	Scovill to Woodland	1,084		
6	Cedar	Greenwood west	619		
6	Kennard	Euclid to Prospect	416		
6	Clinton	Liberty to Taylor	704		
6	Perry	Woodland to Orange	366		
6	Cedar	Case av. west	1,462		
6	Carter	Scranton av. to R. R.	865		
6	Lorain	Columbus to Smith	763		Relaid.
6	Champlain	Police Station to Canal st.	840		
6	Sibley	Case av. to Kennard	630		
6	Alabama	Lake st. north	150		Relaid.
6	Liberty	Franklin to Detroit	750		
6	Sibley	Across Case av.	99		
6	Cedar	"	99		
6	Lorain	Columbus to Pearl	540		Relaid.
6	Cross	Hill st. south	16		
6	Franklin	In front of Reservoir	65		Relaid.
6	Muirson	Across Superior	132		
6	Perry	Superior st. pipe south	72		
6	York	Lorain Street north	28		
6	"	" south	38		
6	Willett	"	38		
6	Mechanic	"	38		
6	Burton	"	38		
6	Randall	" north	28		
6	Harbor	"	28		
6	"	" south	56		
6	Taylor	"	38		
6	"	" north	28		
6	Root	"	28		
6	"	" south	38		
6	Liberty	"	38		
6	"	" north	28		
6	Birch	"	28		
6	"	" south	38		
6	Dare	"	38		
6	"	" north	28		
6	Swiss	" south	38		
6	Courtland	" north	28		
6	Guernsey	" south	38		
				22,932	
4	Ontario	Lake to Summit	364		
4	Seneca	"	364		
4	Beech	End of Pipe to Scovill	218		
4	Brainard	Lorain st. south	109		
4	Church	Pearl to Hanover	518		
4	Jay	" York	527		
4	Spruce	Elm to Mulberry	548		Relaid.
4	Chestnut	Oak to Muirson	229		
4	Tracy	Lorain st North	309		
4	Johnson	Bank to Water	479		Relaid.
4	Hur o.	Euclid west to Alley	639		

**SCHEDULE.—CONTINUED.**

DIAM. PIPE INCH'S	STREET.	BETWEEN WHAT STREETS.	FEET PIPE LAID	TOTAL.
4	Hurd.....	Lorain st. pipe north.....	29	
4	Micks.....	“ “ “.....	24	
4	Abbey.....	“ “ south.....	38	
4	McLean.....	“ “ “.....	38	
4	“.....	“ “ north.....	28	
4	Ward.....	“ “ south.....	38	
4	Jersey.....	“ “ “.....	38	
4	“.....	“ “ north.....	28	
4	Penn.....	“ “ “.....	28	
4	Green.....	“ “ south.....	38	
4		Fire Hydrant Connections.....	109	4,794
3	Summit.....	Ontario to Seneca.....	564	
3	Brownell.....	Euclid to Prospect.....	429	
3	Hill.....	Cross st east.....	303	
3		Connections to Fire Hydrants and Cisterns.....	629	1,925
				39,457

**SCHEDULE—CONTINUED.**

**PIPES TAKEN UP AND RELAID.**

SIZE OF PIPE TAKEN UP.	SIZE OF PIPE LAID IN PLACE.	STREET.	BETWEEN WHAT STREETS.	LENGTH.	TOTAL.
8	8	Centre.....	Main and Spruce.....		404
6	6	Franklin.....	In front of Reservoir.....	65	
4	6	Lorain.....	Columbus and Smith.....	763	
4	6	Alabama.....	Lake st north.....	150	
4	6	Lorain.....	Columbus and Pearl.....	580	
4	6	Dodge.....	St. Clair and Lake.....	539	2,097
			Total.....		2,501

**TOTAL PIPE LAID TO DECEMBER 31, 1871.**

Diameter in inches.	24	20	16	12	10	8	6	4	3	2
Previous to 1871.....	2,068	10,913	12,490	1,481	34,066	31,176	65,878	91,589	9,868	817.5
Laid in 1871.....				3,100		6,701	22,932	4,794	1,925	
Total.....	2,068	10,913	12,490	4,581	34,066	37,877	88,810	96,392	11,793	817.5
Taken up in 1871.....						404	65	2,032		
Total in use.....	2,068	10,913	12,490	4,581	34,066	37,473	88,745	94,360	11,793	817.5

**RECAPITULATION OF PIPE NOW IN USE.**

26,071 feet of supply main equal to 4,938 miles.  
 271,018 “ “ distributing “ “ “ “ “  
 297,089 “ “ “ “ “ “ “ “ “

# **SCHEDULE,** **GIVING SIZE, NUMBER AND LOCATION OF STOP** **GATES, SET IN 1871.**

NO.	SIZE IN INCHES.	STREET.	LOCATION.	
			SIDE OF STREET.	
1	12	Franklin	East line of	Kentucky.
1	12	"	West "	Taylor.
1	12	"	West "	Birch.
1	12	"	West "	Courtland.
4	12	Gates		
1	8	Case ave.	South "	Cedar.
1	8	"	North "	Garden.
1	8	Prospect	East "	Kennard.
3	8	Gates		
1	6	Cedar	East "	Hayward.
1	6	"	West "	Greenwood.
1	6	"	East "	Case avenue.
1	6	"	West "	Case avenue.
1	6	Carter	957 feet west of	Scranton avenue.
1	6	Lake	East line of	Brownell.
1	6	"	West "	Dodge.
1	6	"	West "	Buell.
1	6	"	West "	Alabama.
1	6	Woodland	West "	Geneva.
1	6	"	West "	Maple Grove.
1	6	Lorain	East "	Tracy.
1	6	"	East "	Columbus.
1	6	"	West "	"
1	6	Kennard	North "	Prospect
1	6	Sibley	West "	Kennard.
1	6	"	East "	Case avenue.
1	6	"	West "	Case avenue.
1	6	Liberty	North "	Franklin.
1	6	"	South "	Detroit.
1	6	Garden	East "	Perry.
1	6	"	West "	Greenwood.
1	6	"	East "	Greenwood.
1	6	"	East "	Sterling.
1	6	"	West "	Forest.
1	6	Forest	North "	Burwell.
1	6	"	243 feet south of	Croton.
1	6	Clinton	East line of	Liberty.
28	6	Gates		
1	4	Huron	South "	Euclid.
1	4	Tracey	North "	Lorain.
1	4	Chestnut	West "	Muirson.
1	4	Seneca	North "	Lake.
1	4	Ontario	North "	Lake.
1	4	Church	East "	Hanover.
1	4	Jay	East "	York.
1	4	Brainard	South "	Lorain.
1	4	Beech	South "	Scoville.
8	4		Set for Fire Hydrant.	
17	4	Gates		
1	3	Hill	East line of	Cross.
1	3	"	At south end of	Pipe.
5	3	Gates	For Cisterns.	
35	3	"	For Fire Hydrants.	
42	3	Gates	For all purposes.	

# RECAPITULATION.

WATER WAY IN INCHES.	12	8	6	4	3
	4	3	28	17	42

Total number set for all purposes 94.

## TOTAL NUMBER OF STOP GATES SET IN STREETS TO DECEMBER 31st, 1871.

WATER WAY IN INCHES.	24	20	16	12	10	8	6	4	3	2	TOTAL.
Set previous to 1871 . . . . .	2	12	17	3	48	60	159	282	187	7	768
Set in 1871 . . . . .				4	....	3	28	17	42	...	94
Total . . . . .	2	12	17	7	48	63	187	299	220	7	962



# **SCHEDULE, GIVING NUMBER AND LOCATION OF FIRE HYDRANTS, SET IN 1871.**

No.	STREET.	LOCATION.	SIDE OF STREET.
1	Broadway.	350 S. of A. & G. W. R. R.	East
1	"	890 S. of A. & G. W. R. R.	West
1	Kennard	N. E. corner of Prospect	East
1	Sibley	Case Av. and Kennard	South
1	Case	Sibley and Cedar	East
1	"	Cedar and Garden	West
1	"	"	East
1	"	N. W. corner of Garden	West
1	Broadway	Liberty and Brick	East
1	Prospect	Kennard and Wilson Av.	South
1	Liberty	S. W. corner of Detroit	West
1	Garden	Perry and Sked.	South
1	"	Sked and Garden Place	South
1	"	42 ft. E. of Sterling Av.	South
1	Forest	241 ft. S. of Croton.	West
1	Cedar	2 ft. E. of Grant	South
1	"	39 ft. W. of Williams	South
1	"	8 ft. E. of Hayward	South
1	Carter	287 ft. W. of Scranton Av.	North
1	"	587 ft. W. of "	North
1	"	884 ft. W. of "	North
1	Champlain	Near Canal street	North
1	Lake	314 ft. W. of Alabama	South
1	"	Opposite Buell street	North
1	"	248 ft. W. of Briggs.	South
1	"	Opposite Ross	North
1	"	210 ft. E. of Clinton Park	South
1	"	241 ft. W. of "	North
1	Ontario	Near Summit street	West
1	Seneca	"	East
1	Woodland	Opposite Work House	North
1	"	Near Maple Grove St	South
1	"	162 ft. W. of Brown street	North
1	Beech	200 ft. S. of Scovill.	East
1	Longwood	560 ft. S. of "	West
1	Cedar	304 ft. E. of Charles	North
1	Church	At Hanover	South
1	Jay	At York	North
1	Lorain	At Jersey	North
1	Franklin	At Courtland	South
1	"	112 ft. E. of Dare	North
1	"	149 ft. W. of Taylor	North
1	Clinton	At Liberty	South
43 New Fire Hydrants set in 1871.			
308 Set previous to 1871.			
351 Total number in use.			

## **FIRE CISTERNS. CONNECTED WITH WATER PIPE IN 1871.**

1	Greenwood	At Garden.
1	Garden	" Blair.
1	Forest	" Burwell.
1	Perry	" Orange.
1	Franklin	" Liberty.
5 Total.		

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REPORT

OF THE

BOARD OF TRUSTEES

OF

★ WATER WORKS

OF THE

CITY OF CLEVELAND

For the Year 1873.



**REPORT**

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1874

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# REPORT

OF

## Trustees of Water Works.

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To the Honorable City Council:

Gentlemen: The undersigned, Trustees of the Cleveland Water Works, respectfully present their annual report, with the reports of the Secretary, and Superintendent and Engineer, being the eighteenth annual report upon the condition of the works since the introduction of lake water.

It will be observed by referring to the report of the Secretary, that the expenditures of the past year have been large, but the means already provided will probably be sufficient to complete all the various parts of the new work now in progress. The receipts for water during the past year show a satisfactory increase over the preceding one, considering the fact that but little distributing pipe was laid during the season, and that the character of the water furnished was far from desirable for domestic purposes.

We call your attention to the exhibit of the bonded debt of the city for Water Works purposes, and express the hope that no further necessity for the issue of bonds will arise.

The report of the Superintendent and Engineer shows the progress made in the different parts of the works under construction to the end of the year, since which time, by a note added to his report, it will be seen that the lake tunnel has been completed, the last brick was laid February 19th, and on the two following days the work was visited and inspected by the members of the Council and this Board, and many of the city officers and citizens, after which the work of removing the tracks, air pipes and other fixtures and cleaning out the tunnel was prosecuted with such diligence that the water was admitted on the second day of March, filling it in about twenty-four hours. On the evening of the same day the gates in the old inlet were closed and the one in the con-

nection between the tunnel and aqueduct opened, since which time the water supplied to the city has been drawn through the tunnel.

The water pipes so far as practicable have been flushed, and the aqueduct and reservoir will be thoroughly cleaned as soon as the work can be done in the spring.

The new engine house is so nearly completed that the work of setting the new boilers and engines is now being done, and it is confidently expected that the new works will be in full operation by the first of June.

The new main distributing pipe, from the reservoir easterly to Willson avenue, nearly four miles in length, was all laid during the past season, and as soon as the new pumping works are completed it will be used in connection with the other mains to increase the supply of water. In case of accident to either of the old mains, it might be used at once. For details as to cost of works and the progress made in their construction, we would respectfully refer you to the report of the Superintendent and Engineer.

Respectfully submitted,

A. K. SPENCER,  
GEO. H. BURT,  
NELSON PURDY,

Office of Water Works,

Trustees.

Cleveland, O., March 16, 1874.

# SECRETARY'S REPORT.

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To the Trustees of the Water Works:

Gentlemen:—I respectfully submit the following report of the financial condition of this department.

The cash account of the receipts and disbursements for the year 1873, including balances, is as follows:

## RECEIPTS.

For water, including permits.....	\$108,481 00
For water bonds sold at par value.....	200,000 00
For accrued interest on same.....	1,227 40
For interest on sprinkling certificates.....	371 16
Cash balance, December 31, 1872.....	35,209 27
Cash in City Treasury.....	233,522 12
Total .....	\$578,760 95

## DISBURSEMENTS.

For running expenses .....	\$ 38,218 30
For repairs .....	3,673 07
For pipe extension .....	290,020 40
On account of lake tunnel .....	35,530 74
On account of new pumping engines and boilers.....	12,460 63
On account of new engine house.....	63,072 57
On account of aqueduct .....	9,414 47
Cash item (sprinkling certificates) transferred to bills receivable account .....	11,338 93
Cash in City Treasury, December 31, 1873.....	112,863 22
Cash in office, December 31, 1873 .....	2,168 62
Total .....	\$578,760 95



Reference may be had to the report of the Superintendent and Engineer for a detailed statement of the disbursements.

### LEDGER BALANCES, DECEMBER 31, 1873.

FACE OF LEDGER.	DEBITS.	CREDITS.
Bonds .....		\$1,525,000 00
Water rent .....		425,909 07
City of Cleveland .....		48,473 60
Interest and discount .....		3,715 32
Construction .....	\$1,458,744 60	
Lake tunnel .....	125,097 50	
Lake crib .....	105,387 30	
New engine house.....	92,208 63	
New engines and boilers.....	58,525 23	
Aqueduct .....	9,414 47	
Lake shore shaft.....	7,678 06	
Lake shaft .....	10,308 69	
Inlet extension .....	9,362 74	
Bills receivable .....	11,338 93	
Cash .....	2,168 62	
City Treasurer .....	112,863 22	
<b>Total .....</b>	<b>\$2,003,097 99</b>	<b>\$2,003,097 99</b>

The construction account, amounting to \$1,458,744.60, represents the total cost of the Water Works, excepting the new engine house, new engines and boilers, and also the lake tunnel work now being constructed.

There has been expended on the lake tunnel work ..	\$257,834.29
On the new engine house .....	92,208.63
On the new engine and boilers .....	58,525.23
<b>Total .....</b>	<b>\$408,568.15</b>

The account, water rent \$125,909.07 shows the earnings over expenses and repairs since the construction of the works.

The following table exhibits the yearly and aggregate receipts for water, and the expenditures for running expenses and repairs

from the introduction of lake water into the city until the present time; also, the earnings after deducting such expenditures.

Years.	Receipts for water.	Running Expenses.	Repairs.	Receipts less running expenses and repairs.
1856 to 1859.....	\$ 34,528 73	\$ 29,845 49	\$ 2,996 08	\$ 1,687 16
1860 .....	16,793 60	7,683 80	1,734 38	7,375 42
1861 .....	17,097 85	7,768 36	1,350 84	7,978 65
1862 .....	22,730 53	8,066 19	1,291 29	13,353 05
1863 .....	23,421 30	10,011 96	835 54	12,573 80
1864 .....	33,389 49	13,573 26	1,953 49	17,862 74
1865 .....	40,888 01	17,346 56	1,382 21	22,159 24
1866 .....	45,363 70	14,277 13	8,818 77	22,267 80
1867 .....	51,862 45	14,246 06	3,685 79	33,930 60
1868 .....	57,297 98	17,304 32	3,653 43	36,340 23
1869 .....	62,869 72	18,880 13	3,299 56	40,690 03
1870 .....	70,411 18	19,725 24	9,823 99	40,861 95
1871 .....	80,487 44	24,382 16	10,155,33	45,949 95
1872 .....	90,243 96	26,961 65	6,963 49	56,338 82
1873 .....	108,431 00	38,218 30	3,673 07	66,539 63
<b>Total .....</b>	<b>\$755,816 94,</b>	<b>\$268,300 61</b>	<b>\$61,607 26</b>	<b>\$425,909 07</b>

It will be seen from the above that the receipts for water in 1873 are in excess of the receipts of 1872, the sum of \$18,187.04, and that the earnings are in excess for the same time the sum of \$10,200.81.

The accounts of running expenses and repairs for the year 1873, includes not only all the expenses of the department not properly charged to other accounts, but the expenses of keeping all the fire hydrants of the city in good condition, and also some expenses that might with equal propriety have been charged to other accounts.

### BONDS.

The bonded debt of the city for Water Works purposes is as follows:

Seven per cent. bonds due January 1, 1879.....	\$ 400,000 00
Seven per cent. bonds due January 1, 1881.....	100,000 00
Seven per cent. bonds due January 1, 1884.....	300,000 00
Seven per cent. bonds due October 1, 1880.....	75,000 00
Six per cent. bonds due July 1, 1878.....	25,000 00
Six per cent. bonds due July 1, 1879.....	25,000 00
Seven per cent. bonds due May 1, 1892.....	400,000 00
Seven per cent. bonds due May 1, 1893.....	200,000 00
<b>Total .....</b>	<b>\$1,525,000 00</b>

The Sinking Fund of the City, under the control of the Sinking Fund Commissioners, is pledged for the payment of the



**REPORT**

**OF THE**

**BOARD OF TRUSTEES**

**OF**

**WATER WORKS**

**OF THE**

**CITY OF CLEVELAND**

**For the Year 1873.**

**1874**

December. The portion on the lake shore was a very difficult piece of work, the deepest part of the excavation being eighteen feet below the surface of the lake and in quicksand; the distance from the margin of the lake was only fifty feet; the work has been completed in a very satisfactory manner, and without injury to the old aqueduct. As soon as the lake tunnel is completed and cleaned out water may at once be supplied through it to either the old or new pumping works. During the night of the 29th of December and the day following a heavy westerly gale prevailed, lowering the water in the lake over two feet, at the same time ice was forming rapidly and was being driven towards shore in the vicinity of the present inlet to the aqueduct, the water in the aqueduct at the pumping works was observed to be unusually low, but as on several occasions before it had been nearly as low for a short time, no particular notice was taken of the fact, until during the night of the 30th, when the water was so low that only one pump could be kept running at one-fourth of its usual speed, it was then evident that some other cause than low water in the lake prevented a supply reaching the pumps as the wind had gone down and the lake was nearly up to its usual level; an examination of the aqueduct was then made from the engine house to the lake, when it was discovered that from the inlet, for the distance of eight hundred feet inland, it was filled with fine particles of ice which when taken out had the appearance of coarse snow. Within the distance named there are only three openings into the aqueduct, and the progress made in removing the ice was necessarily slow, and about thirty hours elapsed before a full supply of water could be obtained at the pump wells. This is the only time that there has been any trouble from ice in the inlet aqueduct since the works were built, the cause being the extremely low stage of water in the lake just at a time when ice was forming rapidly and being driven in shore in large quantities.

#### NEW ENGINE HOUSE.

The building for the new engine and boilers is nearly completed; the boiler house, including foundations for boilers, is all done, with the exception of the flashing on the roof and hanging the iron doors and shutters. The work remaining to be done on the engine room portion of the building is the covering of the roofs of the angle-rooms, a portion of the flashing of the main roof and a part of the floor flagging, and raised wall around the inside of the building, with the general cleaning and pointing up always necessary after the completion of the masonry; the iron doors and shutters are all made and ready to hang.

#### NEW BOILERS.

The six new improved cornish boilers are completed and placed in position on their supports in the building, the mountings are all ready and will be put in place as soon as the weather will permit;

the masonry for the flues will also be pushed forward as soon as possible.

### NEW ENGINES.

All the heavy castings for the new engines are now in the building and the work of putting them together will be proceeded with at once so as to complete them before the summer increase in the consumption of water begins.

### OLD ENGINES.

The old engines have been able to pump all the water required during the past year, running on an average of eighteen hours and fifty minutes per day, making together about fifteen strokes per minute. The quantity of water pumped by these engines may be materially increased by laying a larger main from the stand pipe to connect with the new thirty six inch pumping main from the new engines, a distance of only two hundred and fifty feet. The increase in head in the stand pipe while running the two pumps together, at fifteen strokes per minute, is six and a half feet, indicating a friction equal to a pressure of over two and three-quarter pounds to the square inch, raising the water in the stand pipe nearly to the top, and preventing greater speed being made by the pumps by substituting a thirty inch pipe for the twenty-four inch now in use for the distance named, the speed of the pumps may be increased nearly, if not quite, one-fourth, and a much better duty as usually computed may be made by the engines, the discharge branch in the base of the stand pipe being thirty-three inches in diameter. The change recommended can be made without difficulty when the new works are put in successful operation. For information regarding other improvements and necessary repairs about the old works I would respectfully call your attention to the report of Mr. John Vial, engineer in charge of pumping works.

### COAL DOCK.

The increasing demand for water and the consequent increase in the consumption of fuel will make it necessary during the coming season to extend the coal dock across the whole river front of the engine house lot; the present dock, occupying about one-third of the river front, is in a dilapidated condition and should be rebuilt at the same time.

### NEW PUMPING MAIN.

The new thirty-six inch pumping main, the laying of which was commenced last year, has been completed and connections made with the reservoir, and also with the old twenty inch distributing and new thirty inch distributing main commenced last year. The pipe has also been laid into the new engine house ready for connecting with the new engines. Branches thirty inches in diameter were inserted in this pipe—with valves on the

ends—where it crosses the twenty-four inch pumping main so that the two pipe may be easily connected, or a thirty inch pipe may be laid to take the place of the one now in use. A pipe of Y form was placed opposite the center of the new building, one branch of which was extended into the building and the other extended to near the building, ready to connect another engine to, whenever it may be necessary; a thirty inch valve is placed in each of these branches. A twenty inch check valve is placed in the connecting branch to the old distributing main and a thirty inch valve of the same kind in the new thirty inch distributing main. These valves being self-acting prevent any back flow from the reservoir or distributing mains in case of breakage in either of the pumping mains.

### NEW DISTRIBUTING MAIN.

The thirty inch distributing main has been extended from a point two hundred feet south of the reservoir, through Kentucky, Bridge, Franklin, Carter and Girard streets, and across a portion of the land belonging to the Cleveland Iron Company to Scranton avenue at Girard street, thence across the land occupied by the Atlantic & Great Western Railway Co. to the Cuyahoga river. The pipe crossing the river is a wrought iron syphon, thirty-three inches internal diameter and two hundred and twenty feet long; it is made of half inch boiler iron, double and square riveted, and is laid in a trench excavated twenty-one feet below the ordinary water line in the river. From the river the pipe is laid through Ohio street and under the Ohio Canal, to the intersection of Ohio, Brownell and Garden streets, where the size is reduced to twenty-four inches and then extended through Garden street to Wilson avenue, connecting with the pipes in the principal cross streets along the line. The portion extending from Erie street to Case avenue has been filled with water, making a very perceptible increase in the pressure of water in the eastern portion of the city. The total length of main pipe from sixteen inches to three feet in diameter, laid during the past year, is three and seven hundred and ninety-three one thousandth miles.

### DISTRIBUTING PIPE.

The quantity of distributing pipe laid during the year was comparatively small, the principal lines being laid in streets about to be paved; the large amount of work to be completed within the year, to make the new pumping works available at the earliest day possible, with the fact that the old works were running to nearly their full safe capacity, made it necessary to defer laying distributing pipes excepting in the most urgent cases until another year. There are now on file in the office of Water Works a large number of petitions to have water pipe laid, many of them deserving of consideration, either on account of the large number of petitioners or the fact that the district to be supplied

lacks water facilities for extinguishing fires. It is believed that after the introduction of tunnel water the applications for water pipe in streets will be more numerous than they have been during any previous year, while the amount of money now at the disposal of this department for such purposes will pay for but a small quantity. Should it be deemed expedient to lay a large quantity of pipe during the season it will be necessary to apply to the City Council for funds to meet a portion of the cost. The total length of distributing pipe laid during the year is 3 872-1000 miles.

The number of new service pipe connections made with the mains during the past year is as follows:

4 inch .....	1
3 inch .....	4
2 inch .....	3
1 inch .....	1
3-4 inch .....	14
5-8 inch .....	906
<b>Total .....</b>	<b>929</b>

The whole number of service pipes connected with the distributing mains and their different sizes is as follows:

4 inch .....	8
3 inch .....	19
2 inch .....	38
1 1-2 inch .....	12
1 inch .....	95
3-4 inch .....	268
5-8 inch .....	5,912

**Total to January 1, 1874.....6,352**

Of the whole number as above stated, 1,064 service pipes are laid only to the stop-cock.

The expenditures for the year by the department, as shown by vouchers in this office, have been as follows:

#### RUNNING EXPENSES.

Pay roll for twelve months (labor).....	\$23,238 96
Coal .....	10,999 27
Oil and tallow .....	464 06
Brass work and ferrules.....	449 93
Printing and stationery .....	369 42
Rent of store room .....	200 00
Hardware, lamp chimneys, etc.....	110 54
Fertilizer for reservoir grass.....	232 50
Sewer tax .....	740 00
Plumbing .....	196 00
Packing for engines .....	435 51
Water meters .....	251 50
Blacksmithing and iron work .....	56 05



Ropes, blocks, etc.	19 22
Soap mixture	29 03
Lumber	14 06
Hose, etc.	68 00
Sewer connections	47 50
Fire clay and masonry	21 25
Lithographing	96 00
Cotton waste	75 67
Car fare	36 36
Repairing ceiling	48 96
Freight	7 52
Stamps	7 50
Sundries	39 66
Total	\$38,243 30

## PIPE EXTENSION, 1873.

Pay roll and labor	\$ 30,231 44
Cast iron pipe and special castings delivered	211,624 84
Valves and air cocks	14,735 32
Pig lead	18,173 38
Wrought iron river pipe	5,398 77
Dredging, pile driving and putting pipe in place	3,007 08
Paid for fire hydrants	2,250 00
Cartage	1,867 66
Blacksmithing and iron work	670 86
Coal	349 00
Plumbing and wrought iron pipe	159 75
Rope and hemp packing	190 84
Derrick	110 76
Freight	110 15
Lumber and carpenter work	525 84
Well holes and mason work	777 68
Paid A. & G. W. R. R. Co. for supporting track	124 25
Printing, etc.	68 25
Wheelbarrows and hardware	73 14
Wooden plugs	35 36
Lanterns and oil	17 50
Lead furnaces	75 00
Paid for re-setting hay scales	58 50
Paid for earth filling	30 10
Sundries, oil, car fare, etc.	125 49
Total	\$291,861 96

## REPAIRS, 1873.

Pay rolls and labor	\$ 2,393 44
Blacksmithing and machine work	496 47
Carpenter work and lumber	187 48
Cartage	100 38
Cement	26 10
Twine and cloth and packing	30 29
Mason work and material	486 43
Paid damages	20 90
Plumbing and fitting	87 51
Castings and hardware	32 94
Paving	77 19
Rubber boots, etc.	22 00
Repairing meters	46 99
Coal and wood	78 25
Pig lead	75 45
White and red lead	9 62
Car fare	2 60

Sundries .....	3 10
Total .....	\$3,777 14

## LAKE TUNNEL, 1873.

Paid A. A. McDonell, estimates.....	\$35,397 34
Paid for tug and boat hire.....	103 90
Paid for labor .....	25 00
Paid for rubber boots.....	4 50
Total .....	\$35,530 74
Expended previous to 1873.....	80,360 80
Total .....	\$115,891 54

## NEW ENGINE HOUSE AND GROUNDS.

Paid contractors, estimates .....	\$60,731 34
Architect .....	1,180 00
Inspector and watchman .....	762 25
Lumber and carpenter work.....	109 75
Grading, sewerage, etc. ....	252 10
Hardware and blacksmithing .....	37 13
Total .....	\$63,072 57
Expended previous to 1873.....	29,136 06
Grand total .....	\$92,208 63

## NEW ENGINES, 1873.

Paid Cuyahoga Steam Furnace Co. ....	\$ 2,030 09
Boilers and fittings .....	10,403 18
Printing .....	17 75
Labor .....	19 50
Lumber .....	20 20
Total .....	\$12,460 63
Expended previous to 1873.....	46,064 60
Grand total .....	\$58,525 23

## AQUEDUCT CONNECTION, 1873.

Pay rolls, labor and estimates.....	\$6,943 94
Brick, cement and sand .....	1,142 82
Coal .....	42 90
Use of steam pump .....	140 50
Lumber, etc. ....	857 61
Cartage .....	9 00
Castings, hardware and blacksmithing .....	175 15
Pipe and fittings .....	16 66
Sundries—oil, mauls, etc. ....	4 89
Total .....	\$9,414 47

Respectfully submitted,

JOHN WHITELAW,  
Superintendent and Engineer.

Cleveland, February 2, 1874.

Note.—Since the above report was written the tunnel has been completed and water is now being drawn through it; the masonry was completed on the 19th of February and on the 2nd day of March all the fixtures had been removed and the tunnel thoroughly cleaned, the gates were opened the same day and water admitted, and during the evening of the following day water was being supplied to the pumps through the tunnel, since which time all the water supplied to the city has been drawn through the tunnel.

## Water Works Engine House, January 1, 1874.

## To the Trustees of Water Works:

Gentlemen:—In accordance with the duty devolving upon me I herewith submit a report upon the condition of the pumping machinery of the water works, with the amount of work done and the repairs and improvements made during the past year:

On the 6th of November, at 9:35 P. M., the West Engine was stopped in consequence of the water leaking through the central part of the main pump plunger around the extension connection rod between the nut and the plunger bottom; the repairs were made with a new nut properly fitted. Both engines were stopped on the 9th of November at 5:10 P. M., the reservoir being full and the supply to the city shut off for the purpose of making repairs on the main pipe; early on the following morning both engines were again set to work.

Both engines were again stopped on the 18th of December at 7:45 A. M., for the purpose of making connections with the new and old aqueducts near the engine house and also on the lake shore. Both engines were again set to work on the following morning at 1:15 A. M. The depth of water in the reservoir being only one and three-quarters feet, and the depth at the time the engine stopped was twenty feet two inches, and the duration of the stoppage of the engines was seventeen hours and thirty minutes; this shows that the reservoir when full contains only three-fourths of one day's supply of water.

On the morning of December 27th, after starting the East Engine No. 1, east boiler was found to be leaking badly along the line of rivets in the furnace over the bridge wall, and the said boiler was thrown out of use for repairs, (the engine being supplied with steam by No. 2 and 3 boilers). On the following day, Sunday, commenced on the repairs of said boiler and completed them on Monday afternoon, and on the following morning, Tuesday, 30th inst., the said boilers were again in use, with the other two boilers all cleaned and in good order, with the brick work repaired and all necessary work done on the details of said boilers; but on account of the ice in the lake end of the aqueduct obstructing the flow of water through it, and the water in the lake being low also, but one engine could be used, making from two to three strokes per minute; the depth of the water in the reservoir in the morning at 7 A. M. was seventeen feet ten inches, and on the following morning, the 31st inst., at 7 o'clock, the depth of water in reservoir was only four feet, the water supply to the pumps being 3-8-10 strokes per minute for the last twenty-four hours; while from about 9 A. M. of yesterday, during the day and the first part of last night, the reservoir was empty.

The average depth of water in the reservoir for the year was nineteen and three-tenths feet. The engines worked during the year six hundred and eighty-three days, the average running time

per day being eighteen hours and fifty minutes—a per diem increase of sixteen minutes, and an increase of ninety-eight days.

Number of strokes made by the east engine.....2,773,075  
 Number of strokes made by the west engine.....3,051,750

Total .....5,824,825

The average height above surface of lake to which water was pumped one hundred and fifty-seven and eighty-eight one-hundredths feet.

Duty of the east engine.....39,980,202

Duty of the west engine.....40,079,125

pounds of water raised one foot high with each one hundred pounds of coal consumed in raising steam and pumping, the coal used being common bituminous slack somewhat mixed with nut coal.

The pumps are working against a main pipe friction head of water of six feet six inches in the stand pipe, which is not taken into consideration in making up the duty of the engines; the pumps are working against a head of one hundred and sixty-four thirty-eight one-hundredths feet, the pump main being somewhat small for the two engines.

The following are the repairs and improvements made during the year:

Put a new brass valve in the cold water pump of the west engine.

New grate bars in the furnaces of two boilers.

Put new and larger rivets in the crown sheet seam of No. 1 east boiler.

Put a new nut on the lower end of the connecting rod of the main pump of west engine.

Put new bolts in the lower valve seat of the east main pump.

A new brass guide to one rod of the valve gear of each engine.

Renewed the lower valve gears wood floors, and repaired the lower valve gearing of both engines.

Renewed the wood floors around the air pumps of both engines.

Put a platform below the floor in the gate house.

Put a new door-closing spring on the tower platform door, and repaired the said door and hand rail of the tower stairs, and the hand rails around the engine beams on the upper floor. Repaired the windows of the tower and boiler house.

The engines, pumps and boilers are in good working condition, excepting that a general overhauling is needed as soon as it can be done conveniently.

The new engines and boiler house, with the engines and boilers will be ready for service by the early part of the coming summer. I beg to recommend as follows:

That a new steam valve and seat, and exhaust valve and seat with new valve stems, be made for each engine.

That a new lower valve chamber be made for the east main pump, the same to be erected with the new stop valve now on hand ready for erection, and that the new lower valve chamber for the west main pump now on hand be erected also, and new oak check blocks be got ready for both main pumps.

That new cast iron cold water cisterns be made for both engines, and the cold water pumps enlarged.

That new boilers and boiler details be made and ready for erection for both engines, and the steam pipes of said boilers be arranged so that either engine can be used with any of the boilers.

And that the foundation and walls of the west boiler house be put in proper condition for new boilers, or a new boiler house be erected for the same.

And that the coal dock be renewed.

The annexed schedule statement gives the record of the engines for the year 1873.

Respectfully submitted,

JOHN VIAL,  
Engineer in charge

## SCHEDULE A.

## ENGINE RECORDS FOR 1873.

## EAST ENGINE.

Months.	Days.	Pumping.			Coal Consumed.			Gallons of Water Pumped.	Height Ft. Dec.	Duty.
		Hours.	Minutes.	Strokes.	Raising Steam.	Pump'g.	Total.			
January . . .	31	570	50	249,075	.....	287,400	287,400	79,953,075	158.982	36,781,516
February . . .	28	540	35	239,950	.....	251,400	251,400	77,023,950	159.059	40,742,542
March . . . .	27	456	25	209,725	.....	231,200	231,200	67,321,725	159.083	38,724,140
April . . . .	26	409	00	183,650	.....	204,600	204,600	58,951,650	157.881	37,865,880
May . . . . .	27	473	50	214,800	2,400	224,800	227,200	68,950,800	157.249	39,855,566
June . . . . .	28	591	45	256,650	.....	259,800	259,800	82,384,660	157.153	41,640,301
July . . . . .	30	604	30	263,600	.....	280,800	280,800	84,615,600	157.192	39,571,695
August . . . .	28	594	35	265,325	.....	272,800	272,800	85,169,325	157.261	40,998,225
September . .	26	561	50	240,850	.....	237,600	237,600	77,312,850	157.513	42,737,580
October . . . .	28	531	20	245,500	.....	246,600	246,600	78,805,500	157.803	41,973,020
November . . .	26	421	30	205,650	2,000	209,800	211,800	66,013,650	157.945	40,948,610
December . . .	27	431	25	198,300	2,400	211,400	213,800	63,654,300	157.760	39,089,540
Total & av's.	332	6,187	35	2,773,075	6,800	2,918,200	2,925,000	890,157,085	157.906	39,980,202

## WEST ENGINE.

January . . .	31	559	10	249,625	.....	284,000	284,000	80,129,625	158.953	37,304,979
February . . .	26	494	00	213,300	.....	244,400	244,400	68,469,300	159.029	37,254,505
March . . . .	30	546	00	259,950	.....	283,000	283,000	83,443,950	159.046	39,209,834
April . . . . .	30	508	30	233,925	.....	265,300	265,300	75,089,925	157.808	37,183,663
May . . . . .	30	547	05	252,825	2,000	268,400	270,440	81,156,825	156.950	39,179,561
June . . . . .	29	618	30	269,850	.....	280,800	280,800	86,621,850	157.193	40,507,495
July . . . . .	31	618	30	272,900	.....	292,000	292,000	87,600,900	157.229	39,412,232
August . . . .	30	628	45	286,300	.....	284,400	284,400	91,902,300	157.269	42,435,867
September . .	29	640	40	283,625	.....	279,800	279,800	91,043,625	157.484	42,585,019
October . . . .	30	542	10	250,075	.....	245,600	246,600	80,274,075	157.768	42,588,503
November . . .	29	494	05	243,950	.....	241,800	241,800	78,307,950	158.036	42,793,129
December . . .	26	483	50	235,425	4,800	233,600	238,400	75,571,425	157.639	41,640,546
Total & av's.	351	6,681	15	3,051,750	6,800	3,204,100	3,210,900	979,611,750	157.866	40,979,125

## BOTH ENGINES.

Total & av's.	683	12,868	50	5,824,825	13,600	6,122,300	6,135,900	1,869,768,835	157.886	40,031,487
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# TOTALS AND AVERAGES FOR BOTH ENGINES FOR EACH YEAR SINCE CONSTRUCTION OF WORKS.

Years	Pump's		Strokes.	Coal Consumed			Gallons Water Pumped	Height		Duty.
	Hours.	Minutes.		Raising Steam.	Pump's.	Total.		Feet.	Decml's.	
1857	1,300	25	399,894	226,200	407,325	633,525	127,262,265	158,000		.....
1858	1,154	55	446,724	232,050	430,225	662,275	142,155,434	156,533	31,453,325	
1859	1,413	00	623,755	233,050	549,600	782,650	198,234,090	155,927	35,697,332	
1860	1,811	05	818,303	298,750	707,950	766,700	260,220,354	156,466	35,206,903	
1861	2,107	35	1,013,129	265,600	854,150	1,118,750	322,175,022	156,432	37,548,089	
1862	2,347	35	1,162,494	276,846	1,115,127	1,391,978	369,673,092	156,357	34,720,024	
1863	2,590	30	1,310,875	281,903	1,169,418	1,551,321	420,790,875	156,693	35,536,438	
1864	2,848	10	1,483,225	274,744	1,445,568	1,720,392	476,114,225	157,313	36,410,146	
1865	2,971	40	1,611,405	286,950	1,579,550	1,866,500	517,261,005	158,017	36,621,770	
1866	3,321	35	1,829,820	276,800	1,925,400	2,202,200	587,372,220	157,731	35,304,587	
1867	3,870	10	2,169,375	270,200	2,162,400	2,432,600	696,369,375	157,439	37,685,498	
1868	4,503	13	2,394,975	198,100	2,078,600	2,276,700	768,786,975	157,822	44,364,421	
1869	5,673	00	2,800,425	70,000	2,585,000	2,655,000	898,936,425	157,509	44,587,144	
1870	6,852	20	3,508,500	49,000	3,388,200	3,437,200	1,126,228,500	156,970	43,010,630	
1871	8,648	35	4,260,500	63,200	4,332,400	4,395,600	1,367,621,100	157,781	41,108,940	
1872	10,562	57	5,253,495	45,200	5,430,800	5,476,000	1,646,370,895	158,377	40,788,146	
1873	12,868	50	5,824,825	13,600	6,122,300	6,135,900	1,869,768,835	157,386	40,031,983	

## SCHEDULE B.

### SHOWING THE DISTRIBUTION OF WATER FOR EACH MONTH IN 1873.

Month.	Gallons of Water Distributed.			
	Per month.	Average per day.	Ea. Inh. per day.	Ea. Co's'r per day.
January	160,082,700	5,163,958	44.52	139.57
February	145,493,250	5,196,187	44.79	140.44
March	150,765,675	4,863,409	41.93	131.44
April	134,041,575	4,468,052	39.38	120.76
May	150,107,625	4,842,181	41.74	130.87
June	169,006,510	5,633,550	48.56	152.26
July	172,216,500	5,555,371	47.89	150.14
August	177,071,625	5,711,988	49.24	154.38
September	168,356,475	5,611,883	48.38	151.67
October	159,079,575	5,131,599	44.24	138.69
November	144,321,600	4,810,720	41.46	130.02
December	139,225,725	4,491,153	38.71	121.38
Totals and averages	1,869,768,835	5,096,230	43.06	137.71

# TOTALS AND AVERAGES FOR EACH YEAR SINCE COMPLETION OF WORKS.

Years.	Gallons Distributed.				Per Ct. of increase.
	Per year.	Average per day.	Ea. Inh. per day.	Ea. Co's'r per day.	
1857 .....	127,262,265	348,664	7.75	110.68	.....
1858 .....	142,156,434	389,467	8.37	98.44	11.70
1859 .....	198,234,090	518,107	11.31	91.27	39.46
1860 .....	260,220,354	710,984	14.11	101.57	31.87
1861 .....	322,175,022	881,599	16.32	114.50	23.81
1862 .....	369,673,062	1,102,794	19.47	120.57	14.74
1863 .....	420,790,875	1,152,857	20.97	117.54	12.83
1864 .....	476,114,225	1,300,858	21.68	123.89	12.14
1865 .....	517,261,005	1,417,153	21.80	122.70	8.64
1866 .....	587,372,220	1,609,239	22.35	124.26	13.55
1867 .....	696,369,375	1,907,861	23.85	115.98	18.55
1868 .....	768,786,975	2,106,262	24.77	116.08	10.14
1869 .....	898,936,425	2,462,839	27.36	120.20	16.92
1870 .....	1,126,228,500	3,065,558	30.86	113.20	25.28
1871 .....	1,367,621,100	3,746,907	35.68	124.90	21.43
1872 .....	1,686,370,895	4,607,571	40.07	131.64	22.60
1873 .....	1,869,768,835	5,095,230	43.06	137.71	10.85



## SCHEDULE.

## SHOWING THE EXTENSION OF WATER PIPES IN 1873.

Diameter of Pipes in inches.	In What Street.	Between What Streets.	Feet Laid.	Total.	Remarks.
36	Kentucky.	Engine house to reservoir .....		130	
30	Bridge . . . .	Kentucky to Franklin .....	3,308		
30	Carter . . . .	Tracy and Girard .....	1,789		
30	Franklin . . . .	Y pipe in Kentucky, easterly .....	112		
30	Franklin . . . .	Bridge and Tracy .....	884		
30	Girard . . . .	T in Girard to Cuyahoga river.....	491		
30	Kentucky. . . .	Franklin and Bridge .....	678		
30	Ohio . . . . .	Cuyahoga river to Brownell .....	5,027		
				12,289	of 30 in. pipe.
24	Franklin . . . .	30 inlet and 20 outlet at reservoir..	120		
24	Garden . . . .	Brownell and Willson avenue.....	7,466		
				7,586	of 24 in. pipe.
16	Ohio . . . . .	Erie street, bet. 30 and 16 mains.....		24	of 16 in. pipe.
12	Brownell . . . .	Ohio st., bet. 30 and 12 mains.....	18		
12	Franklin . . . .	Courtland and Waverly avenue.....	780		
12	Forest . . . . .	Main pipe in Garden, south.....	39		
12	Scott . . . . .	North and south lines of Franklin..	66		
12	Willson av. . . .	Main pipe in Garden, north.....	24		
				927	of 12 in. pipe.
10	Waverly . . . .	Franklin, south .....	37		
10	Willson av. . . .	Woodland, north .....	1,121		
				1,168	of 10 in. pipe.
8	Case av. . . . .	Garden st. bet. 24 and 6 pipes.....		16	of 8 in. pipe.
6	Arlington. . . .	In Garden .....	36		
6	Brown . . . . .	In Woodland .....	45		
6	Burton . . . . .	Lorain to Buckley .....	2,080		
6	Buckley . . . .	Burton, west .....	43		
6	Birch . . . . .	In Franklin .....	66		
6	Blair . . . . .	In Garden .....	31		
6	Brownell . . . .	Prospect to Ohio .....	846		Relaid.
6	Church . . . . .	In Hanover .....	27		
6	Circle . . . . .	Franklin to Fulton .....	179		
6	Courtland. . . .	In Franklin .....	41		
6	Cedar . . . . .	Perry street, east .....	972		Relaid.
6	Calvert . . . . .	In Garden .....	36		
6	Carr . . . . .	In Woodland .....	45		
6	Cemetery . . . .	In Woodland .....	45		
6	Chester . . . . .	In Woodland .....	35		
6	Dare . . . . .	In Franklin .....	66		
6	Duane . . . . .	In Franklin, south .....	37		
6	Franklin . . . .	12 E. of Kentucky, bet. 12 & 6 pipes	66		
6	Fulton . . . . .	Circle to Bridge .....	1,408		
6	First . . . . .	In Woodland .....	45		
6	Florence . . . .	In Woodland .....	45		
6	Giddings . . . .	In Woodland .....	80		
6	Grant . . . . .	In Garden .....	36		
6	Greenwood . . . .	In Garden .....	87		
6	Greenwood . . . .	Scovill, west .....	734		
6	Garden . . . . .	Kennard to Willson avenue .....	571		
6	Garden . . . . .	Forest and Case avenue.....	1,119		

## SCHEDULE.—Continued.

## SHOWING EXTENSION OF WATER PIPE IN 1873.

Diameter of Pipe in Inches.	In What Street.	Between What Streets.	Feet Laid.	Total.	Remarks.
6	Garden . . .	Brownell and Cheshire . . .	511		
6	Hanover . . .	Church and Clinton . . .	327		
6	Harmon . . .	Garden, south . . .	24		
6	Harper . . .	In Garden . . .	24		
6	Haywood . . .	In Garden . . .	36		
6	Harbor . . .	In Franklin . . .	12		
6	Herald . . .	In Woodland . . .	35		
6	Jackson . . .	In Woodland, south . . .	331		
6	Kentucky . . .	In Franklin . . .	66		
6	Kennard . . .	In Garden . . .	69		
6	Lake . . .	Alabama to Lawrence . . .	1,518		
6	Liberty . . .	In Franklin . . .	16		
6	Linden . . .	Scovill, west . . .	346		
6	Linden . . .	In Garden . . .	24		
6	Laurel . . .	In Garden . . .	24		
6	Maple . . .	In Garden . . .	22		
6	Mahoning . . .	In Garden . . .	33		132
6	Newton . . .	In Garden . . .	36		
6	Ohio . . .	Woodland, north . . .	74		
6	Otis . . .	In Woodland . . .	35		
6	Osborn . . .	In Garden . . .	24		
6	Parkman . . .	Erie to Brownell . . .	1,187		
6	Putnam . . .	In Garden . . .	24		
6	Pier . . .	In Woodland . . .	35		
6	Perry . . .	In Garden . . .	16		
6	Sterling . . .	In Garden . . .	76		
6	Slater . . .	In Woodland . . .	80		
6	Faylor . . .	In Franklin . . .	66		
6	Webster . . .	Erie to Brownell . . .	1,187		
6	Woodland . . .	At. C. & P. R. R. . . .	83		
6	Wheat . . .	In Garden . . .	36		
6	William . . .	In Garden . . .	36		
				15,225	
4	Tyler al. . .	Vermont and Detroit . . .	236		
4	Jay . . .	York and Jersey . . .	586		
4	Kennard . . .	Scovill, south . . .	1,214		
4	Sked . . .	Garden, south . . .	24		
4	St. Clair . . .	Kennard, east . . .	1,223		
4	Maple . . .	Garden and Scovill . . .	1,014		
4	Geneva . . .	In Woodland . . .	12		
4	Walworth . . .	In Central Way . . .	36		
4	. . . . .	Hydrants and cistern con. . .	450		
				4,795	
3	Franklin . . .	In Franklin court . . .	24		
3	Garden pl. . .	In Garden . . .	36		
3	North pl. . .	In Garden . . .	36		
3	. . . . .	Hydrants and cistern connections . . .	36		132

## PIPE TAKEN UP AND RELAID IN 1873.

Size Taken Up.	Size Pipe Relaid.	Street.	Between What Points.	Length	Total.
4	6	Brownell .....	Prospect and Ohio .....	846	.....
4	6	Cedar .....	Perry, east .....	972	1,818

## TOTAL PIPE LAID TO DECEMBER 31, 1873.

Diameter in in.	36	30	24	20	16	12	10	8	6	4	3	2
Previous to 1873	1,570	750	2,668	10,913	12,491	4,581	42,388	45,622	122,735	104,394	12,230	817
Laid in 1873	130	12,289	7,586	.....	24	927	1,168	16	15,225	4,795	132	...
Total	1,630	13,039	10,254	10,913	12,514	5,508	43,556	45,698	137,960	109,189	12,362	...
Taken up in 1873	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,818	.....	.....
Total in use	1,630	13,039	10,254	10,913	12,514	5,508	43,556	45,698	137,960	107,371	12,362	...

48,350

352,455

## RECAPITULATION.

48,350 feet of supply main, equal to 9 miles and 830 feet.

352,455 ft. of distributing main, equal to 66 miles and 3,975 feet.

400,805 feet.

75 miles and 4,805 feet.

## SCHEDULE.

GIVING SIZE, NUMBER AND LOCATION OF STOP  
GATES SET IN 1873.

Number.	Size in inches.	Street.	Side of Street.
1	36	Near engine house .....	Connected with Y pipe.
3	30	Near engine house .....	Connected with Y pipe.
1	30	Bridge .....	East line of Penn street.
1	30	Bridge .....	East line of Hicks street.
1	30	Carter .....	North line of Girard.
1	30	Girard .....	East line of Carter.
1	30	Girard .....	West line of Scranton.
1	30	Ohio .....	West line of Stone's levee.
1	30	Ohio .....	East line of Canal street.
1	30	Ohio .....	West line of Erie street.
1	30	Kentucky .....	South line of Franklin street.
12	30	Gates.	
1	24	Garden .....	East line of Brownell.
1	24	Garden .....	East line of Sterling avenue.
1	24	Garden .....	East line of Case avenue.
1	24	Garden .....	West line of Willson avenue.
1	24	Garden .....	East line of Willson avenue.
5	24	Gates.	
1	16	Carter .....	300 feet west of Girard street.
1	16	Ohio .....	West line of Erie street.
2	16	Gates.	
1	12	Brownell .....	North line of Garden street.
1	12	Franklin .....	West line of Waverly avenue.
1	12	Forest .....	South line of Garden street.
3	12	Gates.	
1	10	Willson av. ....	North line of Scovill street.
1	8	Case av. ....	In Garden street.
1	6	Brownell .....	North line of Ohio street.
1	6	Brownell .....	South line of Prospect street.
1	6	Buckley .....	West line of Burton street.
1	6	Burton .....	South line of Lorain street.
1	6	Blair .....	North line of Garden street.
1	6	Clinton .....	East line of Ann street.
1	6	Fulton .....	West line of Circle.
1	6	Fulton .....	North line of Bridge street.
1	6	Garden .....	At Huntington street.

## SCHEDULE.—Continued.

GIVING SIZE, NUMBER AND LOCATION OF STOP  
COCKS SET IN 1873.

No.	Size in inches.	Street.	Side of street.
1	6	Garden .....	West line of Cheshire street.
1	6	Garden .....	East line of Brownell street.
1	6	Garden .....	West line of Willson avenue.
1	6	Greenwood .....	South line of Garden street.
1	6	Greenwood .....	North line of Garden street.
1	6	Hanover .....	North line of Clinton street.
1	6	Harbor .....	South line of Franklin street.
1	6	Lake .....	East line of Alabama street.
1	6	Lake .....	West line of Lawrence street.
1	6	Linden .....	South line of Scovill avenue.
1	6	Mahoning .....	South line of Garden street.
1	6	Maple .....	South line of Garden street.
1	6	Parkman .....	West line of Brownell street.
1	6	Waverly .....	North line of Franklin street.
1	6	Webster .....	West line of Brownell street.
24	6	Gates.	
1	4	Clinton .....	East line of State street.
1	4	Cook .....	West line of Burton street.
1	4	Jay .....	East line of Jersey street.
1	4	Tyler's alley .....	North line of Detroit street.
1	4	Walworth .....	West line of Central Way.
5	4	Gates .....	For street use.
36	4	Gates .....	For fire hydrants.
41	4	Gates .....	For all purposes.
2	3	Gates .....	Set for fire cisterns.

## RECAPITULATION.

Water way in inches.....	36	30	24	16	12	10	8	6	4	3	Total.
	1	12	5	2	3	1	1	24	41	2	92

**TOTAL NUMBER OF STOP COCKS SET IN STREETS  
TO DECEMBER, 1873.**

Water way in inches..	36	30	24	20	16	12	10	8	6	4	3	2	Total.
Set previous to 1873...	.....	.....	2	12	17	7	56	74	242	384	273	7	1,074
Set in 1873.....	1	12	5	.....	2	3	1	1	24	41	2	.....	92
Total .....	1	12	7	12	19	10	57	75	266	425	275	7	1,166

**AIR COCKS SET IN 1873.**

No.	Size in inch	Street.	Location.
1	2	Bridge .....	78 feet east of Pearl street.
1	2	Kentucky .....	14 feet south of Franklin street.
1	2	Ohio .....	6 feet east of west line of Broadway.
1	2	Ohio .....	5 feet west of Plum street.
1	$\frac{3}{4}$	Carter .....	586 feet east of Columbus street.
1	$\frac{3}{4}$	Franklin .....	At reservoir.
6	.....	Total number of air cocks set in 1873.	

## FIRE HYDRANTS SET IN 1873.

No.	STREET.	Ft.	LOCATION.	SIDE.
1	Blair . . . . .	4	North of Garden street . . . . .	East.
2	Burton . . . . .	30	South of north line of Peach street . . . . .	East.
3	Burton . . . . .	427	South of Lorain street . . . . .	West.
4	Burton . . . . .	387	North of Buckley street . . . . .	East.
5	Burton . . . . .	36	South of north line of Buckley street . . . . .	East.
6	Fulton . . . . .	200	South of Circle . . . . .	West.
7	Fulton . . . . .	3	North of Jersey street . . . . .	West.
8	Fulton . . . . .	114	North of Woodbine street . . . . .	West.
9	Franklin . . . . .	40	West of Scott street . . . . .	North.
10	Franklin . . . . .		West side of Circle . . . . .	South.
11	Garden . . . . .	10	East of west line of Grant street . . . . .	South.
12	Garden . . . . .	152	West of Willson avenue . . . . .	South.
13	Greenwood . . . . .	228	South of Scovill avenue . . . . .	East.
14	Greenwood . . . . .	17	North of Garden street . . . . .	East.
15	Hanover . . . . .	45	South of north line of Clinton street . . . . .	East.
16	Jay . . . . .	446	West of York street . . . . .	East.
17	Jackson . . . . .	9	North of Orange street . . . . .	East.
18	Kennard . . . . .	52	South of Portland street . . . . .	East.
19	Kennard . . . . .	183	South of Outhwaite street . . . . .	East.
20	Lake . . . . .	490	East of Alabama street . . . . .	South.
21	Lake . . . . .	977	East of Alabama street . . . . .	South.
22	Lake . . . . .	23	West of Lawrence street . . . . .	South.
23	Linden . . . . .	316	South of Scovill avenue . . . . .	West.
24	Maple . . . . .	298	South of Garden street . . . . .	East.
25	Maple . . . . .	317	North of Scovill avenue . . . . .	East.
26	Mahoning . . . . .	10	South of Garden street . . . . .	East.
27	Parkman . . . . .	35	West of Allen street . . . . .	South.
28	Parkman . . . . .	9	West of east line of Plum street . . . . .	South.
29	St. Clair . . . . .	202	East of Kennard street . . . . .	South.
30	St. Clair . . . . .		West line of Hoadley street . . . . .	South.
31	St. Clair . . . . .	442	East of Hoadley street . . . . .	South.
32	Willson av. . . . .	118	South of Outhwaite street . . . . .	West.
33	Willson av. . . . .	10	South of Portland street . . . . .	West.
34	Webster . . . . .	158	West of Brownell street . . . . .	South.
35	Webster . . . . .	155	West of Plum street . . . . .	South.
36	Webster . . . . .	212	West of Allen street . . . . .	South.
36	New fire hydrants set in 1873.			
449	Set previous to 1873.			
485	Total.			

## FIRE CISTERNS.

## CONNECTED WITH WATER PIPES IN 1873.

1	Burton .....	At Cook street.
1	Willson avenue .....	At Scovill avenue.

## FIRE CISTERNS.

## DISCONNECTED FROM WATER PIPES IN 1873.

1	Blair .....	At Garden street.
1	Franklin .....	At "Circle."
1	Grant .....	At Garden street.
1	Greenwood .....	At Garden street.
4	Total number disconnected.	









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E. Prince C. 6.

NINETEENTH ANNUAL REPORT

OF THE

BOARD OF TRUSTEES

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1902

OF

WATER WORKS

TO THE

CITY COUNCIL OF CLEVELAND,

TOGETHER WITH

REPORTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1874.

CLEVELAND, O.

CO-OPERATIVE PRINTING CO., 105 SENECA ST.  
1875.

DUPLICATE EXCHANGE 2 AUG 1904

N. EGG, CIVIL ENGINEERS



# NINETEENTH ANNUAL REPORT

OF THE

BOARD OF TRUSTEES

OF

# WATER WORKS

TO THE

CITY COUNCIL OF CLEVELAND,

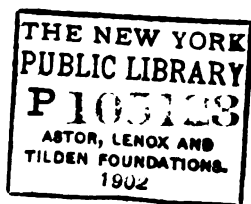
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FOR THE YEAR 1874.



CLEVELAND, O.  
CO-OPERATIVE PRINTING CO., 105 SENeca ST.  
1875



# REPORT OF TRUSTEES OF WATER WORKS.

---

*To the Honorable City Council of Cleveland:*

GENTLEMEN :—In submitting the nineteenth annual report of the Trustees of the Water Works, it appears unnecessary to say but little in addition to the report of the Superintendent and Engineer and that of the Secretary herewith submitted.

These reports furnish a statement of the receipts and expenditures during the year, together with such other information as will enable you to have a full understanding of the condition of this department.

In consequence of the low price of water pipe we have been enabled to contract for a larger quantity to be laid in the year 1875 than was laid during the past year, and we hope to have means from the increase from water rents to lay all the pipe that will pay a reasonable per centage on the cost.

In this connection, we may state that should it be deemed best to lay pipe to supply remote portions of the city with water, more especially for fire purposes, it will be necessary that means be provided to pay for the same.

Respectfully submitted,

GEO. H. BURT,  
NELSON PURDY,  
WALTER BLYTHE,

*Trustees of Water Works.*

OFFICE OF WATER WORKS,

CLEVELAND, O., March 6th, 1875.



# SECRETARY'S REPORT.

---

*To the Trustees of the Water Works:*

GENTLEMEN : I respectfully submit the following as my annual report relating to the finances of this department.

The receipts and expenditures for the year, 1874, including balances, are as follows :

## RECEIPTS.

For water and permits .....	\$116,600 21
Less amount refunded.....	467 18
	<hr/>
For Interest.....	\$116,433 08
For bills receivable.....	423 85
For running expenses account.....	7,553 17
On repairs account.....	38 53
On pipe extension account.....	429 12
On new engine house account.....	2,657 75
Cash in City Treasury, December 31st, 1873.....	18 90
Cash in office, December 31st, 1873.....	112,863 23
	<hr/>
Total.....	2,168 62
	<hr/>
Total.....	\$242,586 24

## DISBURSEMENTS.

For running expenses.....	\$48,990 32
For repairs.....	9,945 11
For pipe extension .....	43,747 96
For lake tunnel. ....	48,140 44
For pumping engines and boilers.....	15,608 34
For new engine house.....	23,673 42
For aqueduct connections.....	683 29
For lake crib.....	4,279 33
Cash in City Treasury, December 31st. 1874.....	41,081 35
Cash and cash items in office, December 31st, 1874.....	6,436 68
	<hr/>
Total.....	\$242,586 24

The disbursements for the year after deducting credits to the accounts are as follows:

Running expenses.....	\$48,951 79
Repairs.....	9,515 99
Pipe extension.....	41,090 21

## REPORT OF TRUSTEES OF WATER WORKS.

5

Lake tunnel.....	48,140 44
New Engines and Boilers.....	15,608 34
New engine house.....	23,654 52
Lake crib.....	4,279 33
Aqueduct connection.....	683 29

Total..... \$191,923 91

## LEDGER BALANCES, DECEMBER 31st, 1874.

FACE OF LEDGER.	DEBITS.	CREDITS.
Construction.....	\$1,936,049 78	
New engine and boilers.....	74,133 57	
City Treasurer.....	41,081 35	
Cash.....	6,436 68	
Bills receivable.....	3,785 76	
Bonds.....		1,525,000 00
Water rent.....		483,874 37
City of Cleveland.....		48,473 60
Interest.....		4,139 17
Total.....	\$2,061,487 14	\$2,061,487 14

The total cost of the Water Works amounts to \$2,010,183.35.

The following table exhibits the yearly and aggregate receipts for water and the expenditures for running expenses and repairs from the introduction of lake water into the city until the present time. Also the earnings after deducting such expenditures:

YEARS.	RECEIPTS FOR WATER	RUNNING EXPENSES.	REPAIRS.	RENTS LESS RUNNING EX- PENSES AND REPAIRS-
1856 to 1859.....	\$ 34,528 73	\$ 29,845 49	\$ 2,996 08	\$ 1,687 16
1860.....	16,793 60	7,683 80	1,734 85	7,375 42
1861.....	17,097 85	7,768 36	1,350 84	7,978 65
1862.....	24,730 53	8,086 19	1,291 20	13,353 00
1863.....	23,421 30	10,011 06	835 54	12,573 85
1864.....	33,389 49	13,573 26	1,933 49	17,862 74
1865.....	40,888 01	17,346 56	1,302 21	22,159 24
1866.....	45,363 70	14,277 13	8,818 77	22,267 80
1867.....	51,862 45	14,246 06	3,685 79	33,930 60
1868.....	57,297 98	17,544 52	3,653 43	36,340 23
1869.....	62,869 72	18,880 13	3,299 56	40,690 03
1870.....	70,411 18	19,725 24	9,823 99	40,861 95
1871.....	80,487 44	24,582 16	10,155 35	45,949 95
1872.....	90,243 96	26,951 63	6,953 49	56,338 82
1873.....	108,431 00	38,218 30	3,673 07	66,539 63
1874.....	116,493 08	48,951 79	9,515 99	57,965 30
Total.....	\$ 872,250 02	\$ 317,252 40	\$ 71,123 25	\$ 483,874 37

The bonded debt of the city for Water Works purposes remains the same amount as at the last annual report, to wit, \$1,525,000.

The annual interest on the same is \$106,250, and is paid by a general tax upon the real and personal property in the city.

The cost of maintenance for 1874 was \$58,467.78; the receipts for water was \$116,433.08, leaving a deficit as compared with the cost of maintenance and interest of \$48,284.70.

I would recommend that the time of payments for water be changed to the months of April and October, as both the consumers and the Water Department would be benefitted by such a change.

H. C. HAWKINS,

*Secretary.*

# REPORT OF SUPERINTENDENT AND ENGINEER.

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*To the Board of Trustees of Water Works:*

GENTLEMEN: The following report upon the condition of the Water Works for the year ending December 31st, 1874 is respectfully submitted.

## AQUEDUCT.

The work of cleaning out the aqueduct between its connection with the Lake tunnel and the pumping works, as promised in the last annual report, was necessarily postponed until another year, or until such time as the new engines shall have been accepted by your Board. The suction pipes of the old pumps are not low enough to render any service in pumping out the aqueduct, and the contractors for the new engines objected to having their engines used for that purpose.

On several occasions during the season the water in the lake has been so low that the old engines did not receive enough to keep them running at the speed required to furnish the quantity used each day, and if the new engines had not been so far completed that they could be used, and permission to use them granted by the builders, there would have been many times during the last half of the year when the supply would have been short.

## ENGINES.

The bottoms of the suction pipes for the old pumps are set only a few inches below low water line, and the consequence is, that during seasons when low water prevails they must remain idle or nearly so, and the City must then depend almost entirely upon the new engines for a supply of water. The bottom of

the aqueduct under the building is one foot higher than it is outside, this arrangement while the quantity of water used by the city was small, worked satisfactorily, as the sand that was carried into the aqueduct with the water was not likely to reach the pumps until it had filled the aqueduct to the depth of one foot, therefore the valves and packing were not in danger from the passage of sand through them, but since the completion of the tunnel the water has been free from sand, and that which before the completion of the tunnel was a wise precaution is now a serious and useless interruption to the flow of water.

The bottom of the aqueduct may be lowered one foot without injury to itself or the building, as its sides are vertical and rest upon a foundation of stone, timber and concrete. The lower valve chambers of both pumps are badly fractured and have been held together for several years by clamps, a new chamber was made for the west pump some years since but has never been put in place; another one for the east pump should be made and both of them set during the coming summer, while this work is being done new suction pipes long enough to extend two feet below low water line, should be made and put in to take the place of the old ones. By making these changes enough water would flow to the old pumps at any time when the new ones were not working to keep them running to their full capacity.

The old aqueduct unfortunately is not deep enough to supply both sets of pumps during low stages of water, the quantity that can be furnished in twenty-four hours is consequently limited to the amount of water the new engines will raise. Early provision will therefore have to be made for an extension of the tunnel from the lake shore to the pumping works, or a new aqueduct at least 8 feet deeper than the present one will have to be built before the end of two years.

The new engines though not completed have been worked at intervals by permission of the builders, since the month of July: sometimes they have been run for several weeks at a time, furnishing all the water used; during a portion of the summer the supply would have been short had they not been so far com-

pleted that they could be used, the builders have consequently been delayed in completing them beyond the time intended. There now remains but a small amount of work to be done upon them to make them ready for the trial test for duty and capacity as provided for in the contract with the builders.

#### BUILDINGS.

The new engine house was completed early in the season. It contains, besides the engine and boiler rooms, a room for the Chief Engineer, one for the Assistant Engineers, one for the firemen, one oil room, one work shop, wash rooms for the engineers and firemen, and four store rooms. The engine room and Chief Engineer's room are heated with steam. During the summer a gas pipe was laid through Division street to the Water Works lot, and by direction of the City Council three gas lamp-posts were set between the old and new pumping works. Gas has been introduced into both buildings, thus supplying a want long felt. Some portions of the wood work of the old building have been removed and others repaired, and the doors and windows have been painted on the outside.

#### GROUND.

Nothing has been done since the completion of the new works in the way of grading or laying out the grounds. The question of laying out a street between the old and new works should be decided before any work of this description is undertaken, as the first thing necessary to be done will be the fencing of the grounds. Early action concerning such improvements as may be necessary to render the place more attractive is recommended.

#### COAL DOCK.

The east half of the coal dock has been thoroughly repaired by cutting off the old piles at the water line, and building up with new oak timber, using new cross timbers where the old ones were decayed, and replanking all the new part. The west half has also received such repairs as were necessary for the present.

#### RESERVOIR.

The water was drawn off from the reservoir and the basins thoroughly cleaned out early in the spring after water from the



# NINETEENTH ANNUAL REPORT

OF THE

BOARD OF TRUSTEES

OF

# WATER WORKS

TO THE

CITY COUNCIL OF CLEVELAND,

TOGETHER WITH

REPORTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1874.



AMERICAN SOCIETY  
CLEVELAND, O.  
CO-OPERATIVE PRINTING CO., 105 SEWCA ST.  
1875



2 inch.....	43
1½ inch.....	12
1 inch.....	99
¾ inch.....	280
½ inch.....	6616

Total to January 1st, 1875.....7089

Of the whole number as above stated 1396 are not in service.

## EXPENDITURES.

## PIPE EXTENSION 1874.

Pay rolls and labor .....	\$ 7,088 02
Pipe and castings.....	25,686 19
Valves.....	3,824 10
Fire hydrants.....	1,242 00
Pig lead.....	1,879 47
Paving.....	2,169 69
Blacksmithing and iron work.....	431 60
Cartage.....	435 00
Packing.....	106 29
Brick and masonry.....	104 12
Advertising.....	12 00
Wooden plugs.....	25 05
Lumber.....	52 32
Coal.....	60 00
Plumbing.....	7 68
Freight.....	25 56
Sundries.....	16 02
	<hr/>
	\$43,744 71

## REPAIRS 1874.

Labor.....	\$5,467 85
Iron work, blacksmithing, &c.....	1,106 08
Tug hire.....	478 00
Brick and mason work.....	345 38
Repairing dock.....	662 73
Painting.....	178 58
Plumbing and fittings.....	250 44
Cartage.....	289 75
Hardware, &c.....	249 47
Rubber valve.....	189 00
Carpenter work and lumber.....	336 80
Grate bars.....	133 80
Repairing meters.....	80 13
Twine, &c.....	41 74
White lead, &c.....	29 63
Coal.....	18 00
Gaskets.....	9 75
Cement.....	3 70
Freight.....	8 99
Sundries.....	49 11
	<hr/>
	\$9,928 75

## RUNNING EXPENSES 1874.

Pay rolls and labor .....	\$28,771 01
Coal .....	10,909 94
Office counter, furniture, &c. ....	1,430 99
Water meters .....	1,897 50
Oil and tallow .....	861 86
Brass work and ferrules .....	506 38
Printing and stationery .....	471 43
Gas bills .....	123 24
Rent .....	925 00
Lumber and carpenter work .....	283 51
Plumbing and gas fitting .....	492 46
Hardware and lawn mower .....	408 85
Legal services .....	350 00
Taxes .....	170 20
Cotton waste .....	114 17
Safe .....	250 00
Heating apparatus at engine house .....	300 00
Blacksmith and machine work .....	28 50
White lead, oil, &c. ....	47 75
Rubber valve .....	44 55
Cartage .....	54 60
Brick and clay .....	23 40
Freight .....	66 37
Rope, blocks, &c. ....	34 79
Survey .....	25 00
Stodding in front of reservoir .....	67 15
Packing .....	88 22
Hose, &c. ....	91 20
Sundries, postage, &c. ....	147 30
	<b>\$48,990 32</b>

## NEW ENGINE HOUSE AND GROUNDS 1874.

Paid contractors, estimates and labor .....	\$22,550 37
Carpenter work and lumber .....	539 75
Gas fitting and plumbing .....	329 39
Castings, &c. ....	61 64
Painting .....	73 14
Coal .....	90 00
Cement .....	28 00
Sundries .....	3 18
	<b>\$23,673 42</b>
Expended previous to 1874 .....	92,206 63
Total cost .....	<b>\$115,882 05</b>

## NEW ENGINE 1874.

Paid Cuyahoga Steam Furnace Co. ....	\$5,000 00
Boiler fittings, Cameron pump, &c. ....	5,723 18
Setting boilers in place .....	180 00
Masonry, setting boilers, &c. ....	2,272 60
Castings, grate bars, &c. ....	1,686 98
Conductors, pipes, &c. ....	316 50
Pay roll and labor .....	232 68
Fire brick and clay .....	128 00
Coal .....	54 00
Advertising .....	14 00
	<b>\$15,008 34</b>
Expended Previous to 1874 .....	58,525 23
Total .....	<b>\$74,183 57</b>

## AQUEDUCT CONNECTION 1874.

Pay roll and labor.....	\$ 194 00
Estimate, masonry, &c.....	274 13
Iron work.....	87 39
Cement.....	56 25
Hardware.....	58 73
Lumber.....	4 10
Cartage.....	8 00
	<hr/>
	\$ 683 29
Expended previous to 1874.....	9,414 47
	<hr/>
Total cost.....	\$10,097 76

## CRIB 1874.

Labor.....	\$ 1,953 38
Iron and galvanized work.....	771 44
Lumber, &c.....	645 37
Fresnal light.....	692 42
Hardware and paints.....	186 91
Glass.....	29 21
Sundries.....	60
	<hr/>
	\$ 4,279 33
Expended previous to 1874.....	105,37 30
	<hr/>
Total cost.....	\$109,066 63

## TUNNEL 1874.

Estimates.....	\$48,072 64
Labor.....	14 00
Tug hire.....	29 00
Lumber.....	21 30
Rubber boots.....	4 50
	<hr/>
	\$ 48,140 44
Expended previous to 1874.....	125,007 50
	<hr/>
Total cost.....	\$173,237 94

**SCHEDULE "A."**  
**ENGINE RECORD FOR 1874.**  
**EAST ENGINE.**

Months.	Days.	Pumping.			Coal Consumed.			Gallons of water pumped.	Height in feet & dec.	Duty.
		h's	M's	Strokes.	Gas & steam	Pump'g	Total.			
January . . .	31	576	25	271,975	.....	277,000	277,000	87,358.370	157.169	40,425,808
February . . .	28	435	45	200,775	.....	212,200	212,200	64,488.920	157.179	39,922,531
March . . . .	26	415	40	190,100	2,400	187,800	190,200	61,060.120	157.151	42,465,660
April . . . . .	35	424	35	196,550	2,400	302,600	205,100	63,131,860	157.069	40,426,710
May . . . . .	28	534	50	260,050	.....	255,400	255,400	83,524,060	157.086	42,936,798
June . . . . .	30	693	15	317,275	.....	309,200	309,200	101,908,730	156.955	43,234,260
July . . . . .	29	667	05	304,950	3,200	302,200	305,400	97,949,940	157.047	42,096,440
August . . . .	24	513	00	239,275	.....	253,000	253,000	76,855,130	157.474	39,878,573
September . .	23	497	40	234,650	2,000	252,800	54,800	75,369,580	157.733	38,231,459
October . . . .										
November . . .	21	374	35	178,900	6,800	195,000	202,400	57,462,680	158.253	37,550,355
December . . .	27	506	35	227,150	.....	257,000	257,000	72,960,580	158.481	37,602,322
<b>Total &amp; ave</b>	<b>289</b>	<b>5639</b>	<b>25</b>	<b>2,621,650</b>	<b>16,800</b>	<b>2,704,800</b>	<b>2,721,600</b>	<b>842,073,980</b>	<b>157.418</b>	<b>40,433,720</b>

**WEST ENGINE.**

January . . .	26	420	35	195,025	.....	219,400	219,400	62,642,130	157.198	37,511,021
February . . .	28	513	50	240,500	.....	270,000	270,000	77,248,600	157.188	37,584,588
March . . . .	31	554	30	271,450	.....	289,800	289,800	87,189,740	157.093	39,473,493
April . . . . .	30	550	50	261,550	.....	264,600	264,600	84,000,860	157.025	41,666,906
May . . . . .	29	568	20	278,575	3,000	267,400	270,400	89,478,290	157.086	43,444,083
June . . . . .	29	606	50	302,750	.....	299,400	299,400	97,243,300	156.968	42,008,727
July . . . . .	25	493	00	221,525	4,000	222,400	226,400	71,153,830	157.057	41,253,361
August . . . .	17	376	50	175,000	4,400	184,300	188,600	56,210,000	157.239	39,167,009
September . .	15	320	30	145,450	3,000	153,600	156,600	46,718,540	157.704	39,295,537
October . . . .										
November . . .	22	392	10	179,850	6,200	199,000	205,200	57,767,820	158.229	37,328,638
December . . .	30	586	15	270,060	.....	304,800	304,800	86,724,000	158.433	37,777,699
<b>Total &amp; ave</b>	<b>280</b>	<b>5443</b>	<b>40</b>	<b>2,541,675</b>	<b>20,600</b>	<b>2,674,600</b>	<b>2,695,200</b>	<b>816,386,110</b>	<b>157.383</b>	<b>39,728,278</b>

**BOTH ENGINES.**

<b>Totals &amp; av.</b>	<b>569</b>	<b>11,083,06</b>	<b>5,163,325</b>	<b>37,400</b>	<b>3,379,400</b>	<b>5,416,800</b>	<b>1,658,460,090</b>	<b>157,400</b>	<b>40,080,999</b>
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**TOTALS AND AVERAGES FOR BOTH ENGINES FOR EACH YEAR  
SINCE THE CONSTRUCTION OF THE WORKS.**

Years.	Pumping.			Coal Consumed.			Gallons of water pumped.	Height. Ft. Dec.	Duty.
	H'rs.	Min	Strokes.	Raising Steam.	Pumping.	Total.			
1857...	1206	25	399,894	226,200	407,325	633,525	127,262,265	158,000	31,453,325
1858...	1454	55	446,724	232,050	430,225	662,275	142,156,434	156,533	35,697,322
1859...	1413	00	623,775	233,050	549,600	782,650	136,234,060	155,927	35,396,903
1860...	1811	05	818,303	298,750	707,950	766,700	269,220,354	156,466	35,296,903
1861...	2107	35	1,013,129	265,600	854,150	1,118,750	322,173,022	156,432	37,548,089
1862...	2347	35	1,162,494	276,846	1,115,127	1,391,978	369,673,062	156,357	34,729,024
1863...	2290	30	1,310,875	281,903	1,169,418	1,551,321	420,790,875	156,693	35,535,428
1864...	2848	10	1,493,325	274,744	1,445,568	1,730,392	476,114,225	157,313	36,430,146
1865...	2671	40	1,611,403	286,950	1,570,550	1,866,500	517,361,013	158,017	37,304,587
1866...	3321	35	1,829,820	276,800	1,925,400	2,304,300	687,372,220	157,731	37,685,498
1867...	3870	10	2,169,375	270,300	2,162,400	2,432,600	696,369,373	157,439	44,364,421
1868...	4503	13	2,394,575	196,100	2,678,600	2,576,700	768,786,975	157,822	44,597,134
1869...	5673	00	2,800,425	70,600	2,845,000	2,655,000	898,936,445	157,769	45,019,620
1870...	6832	26	3,608,500	49,600	3,388,300	3,437,200	1,126,228,500	156,970	41,108,940
1871...	8948	35	4,390,500	65,800	4,332,400	4,393,600	1,367,621,100	157,781	40,788,146
1872...	10,562	57	5,353,495	45,300	5,430,800	5,476,000	1,686,370,895	157,886	40,031,983
1873...	12,868	50	5,824,825	13,600	6,122,900	6,135,800	1,869,769,835	157,886	40,031,983
1874...	11,083	05	5,163,325	37,400	5,379,400	5,416,800	1,638,460,090	157,400	40,190,669

**SCHEDULE "B."**

**SHOWING THE DISTRIBUTION OF WATER FOR EACH MONTH  
IN 1874.**

Months.	Gal's water pumped by Cornish Engines.	Gallons water pumped by Duplex engines.	GALLONS DISTRIBUTED.			
			Per month.	Av. per day.	Each Inhab't per day.	Each consumer per day.
January.....	150,000,500	.....	150,000,500	4,967,758	40.06	124.7
February.....	141,787,530	.....	141,787,530	5,069,197	40.88	127.2
March.....	148,249,860	.....	148,249,860	4,782,253	38.56	120.0
April.....	147,141,720	.....	147,141,720	4,904,724	39.55	123.1
May.....	173,006,850	.....	173,006,850	5,580,850	45.00	140.0
June.....	199,152,030	.....	199,152,030	6,638,401	53.53	166.5
July.....	169,108,770	36,774,562	205,878,332	6,641,238	53.55	166.6
August.....	133,065,130	77,239,723	210,304,853	6,784,027	54.70	170.2
September.....	122,088,120	59,482,892	181,571,012	6,052,367	48.80	151.8
October.....	.....	174,493,067	174,493,067	5,628,408	45.39	141.2
November.....	115,230,500	43,802,577	159,033,077	5,301,102	42.75	138.0
December.....	159,684,580	.....	159,684,580	5,151,083	41.54	129.2
<b>Totals &amp; Averages</b>	<b>1,658,460,090</b>	<b>891,792,820</b>	<b>2,050,252,910</b>	<b>5,625,150</b>	<b>45.36</b>	<b>141.1</b>

The 16th, 17th and 18th, Wards are not included in the above statement.

**TOTALS AND AVERAGES FOR EACH YEAR SINCE COMPLETION  
OF WORKS.**

Years.	Gallons Distributed.				Per Cent. of Increase.
	Per Year.	Average Per Day.	Ea. Inhab. Per Day.	Ea. Cons'r Per Day.	
1857.....	127,261,265	348,694	7.75	110.68	.....
1858.....	142,155,434	389,467	8.37	93.44	11.70
1859.....	198,234,090	513,107	11.31	91.27	39.45
1860.....	260,220,354	719,984	14.11	101.57	31.87
1861.....	322,175,022	881,599	16.32	114.50	23.81
1862.....	369,673,062	1,012,794	19.47	120.57	14.74
1863.....	420,790,875	1,152,857	20.97	117.54	12.83
1864.....	470,114,225	1,290,858	21.68	123.89	12.14
1865.....	517,261,005	1,417,153	21.80	122.79	8.64
1866.....	587,372,220	1,609,239	22.35	124.26	13.55
1867.....	696,369,375	1,907,861	23.85	115.98	18.55
1868.....	768,786,975	2,106,265	24.77	116.08	10.40
1869.....	898,936,425	2,462,839	27.36	120.20	16.92
1870.....	1,136,228,500	3,085,558	50.86	113.20	25.28
1871.....	1,367,621,100	3,746,907	35.68	124.90	21.43
1872.....	1,686,370,895	4,607,571	40.07	131.64	22.67
1873.....	1,869,768,835	5,095,220	43.06	137.71	10.85
1874.....	2,050,252,910	5,625,150	45.36	141.1	9.65

## SCHEDULE

SHOWING THE EXTENSION OF WATER PIPE IN 1874.

Diameter of Pipe in inches.	Street.	Between what Points.	Feet of pipe laid.	Total.	Remarks.
8	Bank	Superior and St. Clair	743		
8	Broadway	From Jefferson street sou'ly	1,934		
8	Kinsman	From Willson ave. southerly	1,670		
8	Orange	In Case avenue	5		
8		Cross and Perry	1,750		
8	Prospect	From w. line Willson av. east	11		
8	St. Clair	Be. 8&6 pipes in B'k & St. Cl'r	36		
				6,149	of 8 inch pipe.
6	Alabama	St. Clair and Superior	782		
6	Bank	St. Clair north	170		Relaid.
6	Barber avenue	In Columbus	66		
6	Cemetery	From Woodland ave. north	17		
6	Cedar avenue	From Case avenue east	30		
6	Case avenue	Woodland and Croton	970		
6	Croton	In Case avenue	53		
6	Courtland	Franklin to Bridge	1,065		
6	Delaware	Superior to Payne avenue	1,019		
6	Fulton	Bridge to Lorain	850		
6	Fillmore	In Columbus	30		
6	Greenwood	Scovill to Marion	458		
6	Hurd	Lorain to Bridge	734		
6	Harbor	Franklin south	580		
6	Jackson	Croton to Orange	620		
6	Marion	South in Chestnut	42		
6	Monroe	York to Mill	477		
6	Outhwaite	Willson ave. to Kennard	1,235		
6	Phelps	St. Clair to Superior	885		
6	Professor	Literary to College	496		
6	Queen	In Columbus west	30		
6	Sterling avenue	From Garden south	20		
6		From St. Clair south	12		
6	Stone's Levee	Central Way to near Ohio	1,061		
6	Sibley	Perry to Cleve	734		
6	Tracy	Lorain to Willey	1,423		
6	Vega avenue	In Columbus east	36		
6	Wade avenue	In Columbus	66		
6	Willson avenue	Euclid south	14		
6	Woodland avenue	From C. & P. R. R. to Mad. av	165		
6	Walton avenue	Columbus to Mill	450		
6	York	In Monroe street	30		
				14,614	of 6 inch pipe.
4	Academy lane	St. Clair to Lake street	641		
4	Bridge	Hurd to Pearl	769		
4	Bond	In Lake street north	51		
4	Church	In State street east	52		
4	Central Place	In Eagle street north	125		
4	Engine House	From 8 in. waste p. to B. H.	189		
4	Frankfort	Bank to Water street	484		Relaid.
4	Hamilton	From Alabama west	394		
4	Howe	Ontario west	403		Relaid.
4	Humboldt	From Croton south	40		
4	Kent	In Lake street south	46		
4	Lawrence	St. Clair north	196		Relaid.
4	Lamolle	In Columbus east	36		
4	Mill	Monroe to York	326		
4	State	Franklin to Clinton	413		
4	Wilson	Briggs street west	1,107		
4		Forward			
				5,255	

SCHEDULE.—CONTINUED  
SHOWING THE EXTENSION OF WATER PIPE IN 1874.

Diameter of Pipe in Inches.	Street.	Between what Points.	Feet of pipe laid.	Totals.	Remarks.
4	Wood.....	Brought forward.....	5,255		
4		In Lake street north.....	53		
4		Hydrants and cistern con's.....	501		
				5,809	of 4 inch pipe.
3	Boiler House.....	For pressure gauges.....	48		
3	Franklin Court.....	From Franklin south.....	740		
3	Miami alley.....	In Bolivar north.....	32		
3	Second alley.....	" " ".....	32		
3	Third alley.....	" " ".....	162		
3	Williams.....	" Lake street south.....	36		
				1,050	of 3 inch pipe.

SCHEDULE OF PIPE TAKEN UP AND RELAID IN 1874.

Sizes in Inches of Pipe Taken Up.	Size of Pipe Relaid.	Street.	Between what Points.	Feet of Pipe Total.	Total.	Remarks.
4	6	Bank.....	St. Clair north.....	170		
4	4	Frankfort.....	Bank to Water.....	484		
4	4	Howe.....	Ontario west.....	406		
4	4	Lawrence.....	St. Clair north.....	186		
4	8	Orange.....	Cross east.....	120		
					1,366	taken up.

TOTAL FEET OF PIPE LAID TO DECEMBER 31st, 1874.

Diameter in inches.	36	30	24	20	16	12	10	8	6	4	3
Previous to 1874....	1,630	13,039	10,254	10,913	12,514	5,508	43,556	45,698	137,960	107,371	12,362
Laid in 1874.....								6,149	14,614	5,809	1,050
Total.....	1,630	13,039	10,254	10,913	12,514	5,508	43,556	51,847	152,574	113,180	13,412
Taken up in 1874.....										1,366	
Total in use.....	1,630	13,039	10,254	10,913	12,514	5,508	43,556	51,847	152,574	111,814	13,412
			4,8350					378711			

RECAPITULATION.

48,350 feet of supply main equal to 9 miles and 830 feet.  
378,711 feet of distributing main equal to 71 miles and 3,831 feet.

427,061 feet.

80

4,761 feet.



## SCHEDULE.

GIVING SIZE, NUMBER AND LOCATION OF STOP GATES SET IN 1874.

No.	Size in Inches.	Street.	Side of Street.
1	8	Bank .....	North line of Superior.
1	8	Bank .....	South " " St. Clair.
1	8	Broadway .....	" " " Independence.
1	8	Broadway .....	483 feet south of Holly.
1	8	Kinsman .....	East line of Willson avenue.
1	8	Kinsman .....	West line of Ensign street.
1	8	Orange .....	" " " Perry.
1	8	Orange .....	247 feet west of Cherry lane.
8			
1	6	Alabama .....	North line of Superior.
1	6	Bank .....	" " " St. Clair.
1	6	Cemetery .....	" " " Woodland.
1	6	Courtland .....	South " " Franklin.
1	6	Courtland .....	North " " Bridge.
1	6	Case avenue .....	South " " Orange.
1	6	Delaware .....	" " " Superior.
1	6	Delaware .....	North " " Payne avenue.
1	6	Fulton .....	South " " Bridge.
1	6	Greenwood .....	" " " Marion.
1	6	Hurd .....	" " " Bridge.
1	6	Jackson .....	North " " Croton.
1	6	Murison .....	South " " Chestnut.
1	6	Monroe .....	West " " York.
1	6	Outhwaite .....	" " " Willson avenue.
1	6	Outhwaite .....	East " " Kennard.
1	6	Phelps .....	North " " Superior.
1	6	Professor .....	South " " Literary.
1	6	Professor .....	North " " College.
1	6	Sterling avenue .....	South " " Garden.
1	6	Stone's Levee .....	West line of Central Place.
1	6	" .....	" " " Toronto.
1	6	Sibley .....	" " " Cleve.
1	6	Tracy .....	South " " Lorain.
1	6	" .....	North " " Freeman.
1	6	Woodland .....	12 east of E. rail C. & P. R. R.
1	6	Walton avenue .....	West line of Columbus.
1	6	" .....	East " " Mill.
28			
1	4	Academy Lane .....	North line of St. Clair.
1	4	" .....	South " " Lake.
1	4	Bridge .....	East " " Pearl.
1	4	Church .....	" " " State.
1	4	Griswold .....	North " " Kinsman.
1	4	Humboldt .....	South " " Croton.
1	4	Hurd .....	North " " Lorain.
1	4	Hamilton .....	West " " Alabama.
1	4	Mill .....	South " " Monroe.
1	4	Superior .....	East " " Water.
1	4	State .....	North " " Franklin.
1	4	Willson .....	West " " Briggs.
19			For street use.
42	4	Gates .....	For fire hydrants.
54	4	Total .....	
1	3	Floyd .....	East line of Jackson con's F. cistern.
1	3	Franklin Court .....	South line of Franklin.
1	3	Third alley .....	North " " Bolivar.
1	3	Williams .....	South " " Lake.
4	3		Gates for street use.

## SCHEDULE.—CONTINUED.

GIVING SIZE, NUMBER AND LOCATION OF STOP GATES SET IN 1874.

No.	Size in inches.	Streets.	Side of Street.
4	3	Gates for street use	Brought forward.
1	3	Gates	for fire hydrant in Franklin court.
5	3	Gates	for all purposes.

## RECAPITULATION.

Water way in inches.	30	24	20	16	12	10	8	6	4	3	Total.
							8	28	54	5	95

## TOTAL NUMBER OF STOPGATES SET IN STREETS TO DECEMBER 31st, 1874

Water way in inches.	36	30	24	20	16	12	10	8	6	4	3	Total
Set previous to 1874	1	12	7	12	19	10	57	75	260	425	275	1,067
Set in 1874								8	28	54	5	95
Total	1	12	7	12	19	10	57	83	284	479	280	1,162

## FIRE HYDRANTS SET IN 1874.

No.	Street.	Feet.	Location.	Side.
1	Academy lane	106	North of St. Clair	East.
1	Alabama	352	South of St. Clair	East.
1	Bank	266	North of Superior	East.
1	Bank	16	North of south line of St. Clair	East.
1	Barber avenue		Southeast corner Barber avenue and Columbus st.	South.
1	Bollivar	89	East of Third alley	North.
1	Bridge	2	West of Hicks	North.
1	Broadway	51	South of Holly	East.
1	Broadway	477	South of Holly	East.
1	Broadway	589	North of Davies	East.
1	Broadway	65	North of Davies	East.
1	Courtland	454	North of Bridge	East.
1	Case avenue	95	South of Orange	East.
13			Forward	

## FIRE HYDRANTS SET IN 1874.—CONTINUED.

No.	Streets.	Feet.	Location.	Side.
13			Brought forward.	
1	Delaware	412	South of Superior	East.
1	Delaware	5	North of Payne avenue	East.
1	Franklin court.	390	South of Franklin	East.
1	Fulton		At Carroll	West.
1	Greenwood	224	North of Scovill	East.
1	Hurd	3	South of Moore	East.
1	Hurd	67	South of Bridge	East.
1	Harbor	28	South of north line of Woodbine	West.
1	Hamilton	340	West of Alabama	South.
1	Kinsman	303	South of Willson avenue	West.
1	Kinsman	315	North of Ensign	West.
1	Kinsman	250	South of Ensign	East.
1	Monroe	20	West of east line of Ward street	South.
1	Mill	16	North of south line of York	West.
1	New engine house.			South.
1	Outhwaite avenue	357	West of Willson avenue	South.
1	Outhwaite avenue	279	East of Kennard	South.
1	Orange	514	East of Cross	South.
1	Orange	16	East of Cherry lane	South.
1	Phelps	406	South of St. Clair	South.
1	Professor	5	North of College	East.
1	Stone's Levee	49	West of Toronto	West.
1	Sibley	327	East of Perry	South.
1	Sibley	11	West of Cleve	North.
1	Tracy	156	North of Abbey	North.
1	Tracy	12	North of Freeman	East.
1	Tracy	10	South of north line of Willey	East.
1	Willson	13	West of Briggs	South.
1	Willson	543	West of Briggs	South.
1	Willson	460	East of East Park	South.
1	Walton avenue	5	East of Mill street	South.
44	Total.			

## FIRE CISTERNS.

## CONNECTED WITH WATER PIPES IN 1874.

No.	Street.	Location
1	Floyd	At Jackson.

## FIRE CISTERNS.

## DISCONNECTED FROM WATER PIPES IN 1874.

No.	Street.	Location.
1	Bolivar	At Third alley.
1	Columbus	At Barber avenue.
2	Total.	

## LAKE TUNNEL.

## FINAL REPORT.

Length from shaft to shaft following the curves 6661  $\frac{51}{100}$  feet, distance in a direct line 6,606 feet. Vertical diameter  $5\frac{1}{2}$  feet, horizontal diameter 5 feet. Depth of Lake shaft below surface of water  $90\frac{3}{4}$  feet, bottom of shore shaft  $67\frac{5}{8}$  feet below surface of water. Internal diameter of each shaft 8 feet. The Protection Crib is built of 12 inch square white pine timber, 61 feet high, pentagonal in form, each outer side measuring 54 feet, each side of inner wall forming well hole measures 19 feet, there is also a middle wall midway between the outer and inner walls. The distance from the inner to the outer wall is 24 feet, all of the walls are tied together and braced in the most substantial manner. The faces of the outer, middle and inner walls are covered with 2 inch oak plank securely spiked to the timber, and the courses of timber are bolted together with drift bolts 1 inch to  $1\frac{1}{4}$  inch square and 30 inches long. The space between the inner and outer walls is filled with stone from the bottom of the crib to the underside of the floor or deck, which is 12 feet above the surface of the lake. From low water line to a depth of 5 feet, the space between the outer and middle walls is filled with concrete for the purpose of forming a foundation for a permanent superstructure, to be built whenever the present one becomes unsafe from decay of the timber. About 400 cords of stone are piled against the outside of the crib. A portion of the building on the crib used as a shelter for the men, materials and machinery, has been fitted up as a dwelling for the light keeper, and the whole is surmounted by a light house 50 feet above the water, in which there has recently been placed a government light of the sixth order, visible from all points of the compass, making a very valuable beacon to navigators approaching our harbor. The work of building the tunnel was commenced August 23d, 1869, and ended March 2d, 1874. On the following day water was being drawn through it for supplying the city, since which time it has supplied all the water pumped.

From the very beginning one difficulty after another presented itself until the final completion, the first of which was a bed of quicksand about 20 feet thick, through which the shore shaft was built, but as the preliminary borings had revealed the nature of the ground at that point, the plans provided for the use of iron cylinders to a depth where the hard clay would be reached, and that part of the work was successfully accomplished. The next difficulty encountered was an irruption of water and inflammable gas in the bottom of the shore shaft, this caused some delay but was shut out when covered with the masonry. A small spring of water was met at about 200 feet from the shaft but it did not cause much trouble or delay. The first great difficulty was the bursting in of the clay and the exposing of a seam through which gas, water and quicksand poured in such quantities that to save the work already done, or as much of it as possible, it was necessary to build a brick bulkhead across the tunnel as near the break as possible. Before this could be done about 300 feet of the tunnel had filled with sand, making it of course necessary to abandon that length of finished work, this happened at a distance of 1300 feet from the shore shaft. As it was now impossible to complete the tunnel on a straight line as originally intended, a deflection of  $20^{\circ}$  to the west was made by an easy curve. After running far enough on this line to reach a point that would be about 40 feet distant at right angles from the original line, the course was again changed so as to carry the work out on a line parallel to the one abandoned. A small quantity of water continued to find its way through the masonry at this place up to the time of completing the tunnel.

That these underground springs are connected was shown by the drying up of the one near the shore shaft after the water found an outlet at the outer one, subsequently the outer one ceased running for a time, and the one near the shaft commenced flowing again. These changes occurred several times—when one was running the other was dry. The approach of a storm was invariably indicated by an increase in the quantity of water and gas discharged, and a corresponding decrease took place as the storm passed. From the time this place was

passed until a distance of nearly 4,000 feet from shore was reached, no farther difficulties were encountered, but on the night of April 29th, 1871, the workmen were alarmed by a loud noise behind them, resembling escaping steam. Not knowing the cause, the men rushed out towards shore, and found that at a distance of 600 feet back of where they were working, the water was pouring through the masonry for a distance of 150 feet in innumerable fine streams, which, in the aggregate, made a large stream of water, too great for the pumps then used to dispose of. So suddenly did this happen that the men left their clothing, dinner pails, tools and three cars of material behind them, fearing to return for them on account of the great flow of gas. After pumping for a short time it became evident that more pumps would be necessary, as the water was gradually raising. One large pump in addition to the two heretofore used was placed in the shaft and worked, and the water could then be kept out. The quantity running in at first amounted to about 8,000 barrels in 24 hours, but after pumping for about a week the quantity decreased to about 6,000 barrels in the same time. This decrease in quantity was a hopeful sign, and it was determined, after knowing that the water could be kept out, and that the flow was decreasing, to discontinue all work in the shore section, and allow it to fill with water. By so doing it was hoped and believed that the leak would nearly if not quite cease by the time the lake section was ready to be connected with it.

During the time the shore section was being built the protection crib for the inlet shaft in the lake had been constructed and taken out to its place. The original height of this structure was 44 feet, 8 feet of which was to be above water when finished, but it was soon found necessary to increase the height, both on account of the yielding nature of the clay into which it settled when filled with stone, and to raise the floor or deck high enough to prevent the water from sweeping across it during storms. Seventeen courses of timber were added, making a total height of 61 feet, and leaving the top of the crib 12 feet above the water line. Before the crib was fully completed it had settled down 13 feet into the clay. The stone placed

around the outside, as before mentioned, was filled to a height of 20 feet against the sides, excepting at the inlets, forming a brace 33 feet high against the outside walls, and preventing any further settlement. It is now four years since it was placed in the lake, and during that time it has been exposed to storms and heavy fields of floating ice without any serious damage having been done to it. The inlet shaft extending from a short distance below the floor of the crib down to the top of the tunnel is of iron, 46 feet of the lower portion is of cast iron 2 inches thick, and is put together in six sections, each of which is 7 8-12 feet long. Four sections of  $\frac{3}{8}$  inch boiler iron, with cast iron flanges, bolted together in the same manner as the cast iron sections, completed the iron portion of the shaft.

When the water was admitted, two of the upper sections were removed and the water now flows over the top of the shaft, which is 9 feet below the surface. It was believed that by adopting the plan of taking the water over the top of the shaft, instead of through gates in the sides, that the large area thus obtained would prevent the accumulation of ice about the inlet, so troublesome to some water works. The water is admitted to the well hole in the crib through two openings near the bottom of the lake, each of them large enough to supply all the water the tunnel will deliver. Gate wells extend from these openings to the top of the crib, and provision is made in them for putting in screens, but they have never been used. The two cylinders removed from the top of the shaft remain on the crib, and in the event of its becoming necessary for any purpose to pump out the tunnel they can easily be replaced, thus shutting off the water as effectually as with gates.

From a little above the high water line for 5 feet down the outside of the crib is plated with boiler iron  $\frac{1}{4}$  inch thick on the three exposed sides and  $\frac{3}{8}$  inch on the two sides facing shore. This was found necessary to prevent the thin ice from cutting through the plank and timber. The first winter the crib was in the lake the ice cut grooves in the plank an inch deep. The first winter after the plates were put on all the spikes in the two rows nearest the water line were drawn out nearly an inch by the expansion in

the formation of ice. That, however, seems to be the limit of disturbance from that cause, as during the two succeeding winters the spikes have remained the same. In sinking the lake shaft a good deal of trouble was experienced from the swelling up of clay from the bottom, and the contractor estimated that he had taken out nearly three times as much clay as was due to the depth of the shaft. For several days scarcely any headway could be made, and on several occasions while work was temporarily stopped the clay raised up to nearly the same height that it was at the beginning of the preceding shift of diggers. As the cylinders were lowered the clay became harder, until finally it was firm enough to keep its place. After hard clay was reached, the cylinders were suspended and the shaft excavated to its full depth, or 15 feet below the iron lining. The clay for that depth remained in its place without support until the brick work was finished.

When the masonry in the shaft was completed work in the tunnel was commenced and carried on until winter setting in prevented the transportation of materials out from the shore.

The tunnel at the lake shaft is nearly 25 feet deeper than the outer end of the shore section; it was therefore necessary to build the remaining portion on an ascending grade to join the finished part, the ascent being nearly one foot in one hundred.

At a distance of 380 feet from the lake shaft the same kind of clay that had caused so much trouble in the shaft was again entered, and, as at this point, it was much lower than in the shaft, the increased pressure and the horizontal direction of the excavation made the work very difficult, and after completing about 30 feet in it the clay ran in faster than it could be removed and allow time to put in the masonry. It then became necessary to brick up the outer end until some plan could be devised for keeping the clay in place while putting in the brickwork.

For this purpose a shield was made of heavy boiler iron, braced with two cast iron rings, 4 inches square in their radial section and enlarged where the cylinders for the hydraulic presses passed through them. The shield was 6 feet in length and  $6\frac{1}{2}$  feet internal diameter, just large enough to allow a section of the tunnel to be built inside of it. In the front or



cutting end, provision was made for putting in shelves and upright divisions 9 inches wide, dividing the opening in the face into squares of about 18 inches. These were never all put in, as it was found in practice that the friction of the clay passing over about two of the horizontal shelves was sufficient to prevent it from running in too fast. The rear part of the shield for two feet in length was smooth and unobstructed on the inner side, so as to allow it to slide away from the masonry without disturbing it. Usually about 16 inches, or two lengths, of brick were put in each time the shield was moved, leaving 8 inches of the finished masonry at all times within the shell. With all possible care taken, cracks would appear in the masonry after moving the shield forward. These, however, only appeared in the very soft clay, which extended for a distance of about 30 feet, and were all crosswise and at the junction of the last with the preceding shift of masonry. At all of these cracks cast iron rings, 12 inches wide and 1 inch thick, put together in segments and set in cement mortar, and keyed up tight, were let into the brickwork.

The first attempt to put the shield in was at about 18 feet from the end of the tunnel and resulted in failure, as the clay began to run soon after the brick-work was removed, and a timber bulk-head had to be put in at once to keep it in place, 12 feet farther back, the clay being firmer the shield was set without difficulty; 30 feet of tunnel and two bulkheads had to be taken out and the tunnel rebuilt as the shield was pushed forward, this delayed the work nearly a month, the removal of the wooden bulk-head alone occupying several days. The use of the shield was necessary for a distance of about 140 feet. When first put in, 12 large screws were used to push it forward; but the progress was so slow that they were taken out and hydraulic presses having an aggregate power of 135 tons put in their place, with this great power it was at times almost impossible to force the shield forward, and in spite of all efforts made to keep it in line, it worked to the left of the proper course  $2^{\circ} 46'$  and in passing through the very soft clay it worked downwards for a short distance, making the tunnel at that point a little below the proper grade line. The pressure on the shield was about 4 tons to the

square foot, and proved to much for its strength, the cast iron rings were broken in several places and the cylinder flattened about 4 inches. After being taken out it was never necessary to use it again, the clay throughout the rest of the work being firm enough to keep its place without support until the masonry was put in. The material through which the tunnel was built was unstratified blue clay interspersed with boulders, very uniform in its general composition, but varying in its solidity, some portions being dry and hard, and others moist and soft. The hard clay was very much broken up in places by irregular cracks running in all directions, but the general direction of the mass of broken up clay was from north-west to south-east. The faces of the clay divided by the cracks had a uniformly smooth though not regular surface, unlike recent fractures. The boulders varied in size from about 4 cubic feet down to coarse gravel, only two were found that gave the workmen any trouble to handle and they were taken out without being broken up. Many of them were rounded and striated, others were rough and angular. More were found near the shore than farther out, but they were not numerous in any part of the excavation, none were found in the soft clay. Nearly all the varieties of rock found between here and Lake Superior were represented, the greater number were of green and black shale and the different shades of limestone found on the islands and main land at the west end of the lake. The distance from the surface of the lake to the rock under the clay at the shore shaft, is 80 feet and at the crib is 117 feet, the rock is a soft, light colored shale.

The progress made in building the tunnel after the shield was taken out was very satisfactory, and nothing occurred to cause any delay until the lake section had been completed to within 20 feet of the outer end of the shore section, and work was about to be suspended in the tunnel until the old portion could be pumped out, when a large mass of clay in the face of the excavation was blown into the tunnel with great force, throwing the workmen down and putting out their lights, after which gas and water appeared in large quantities driving the workmen out

and making it unsafe to work with open lights. As the water gradually filled the lake section it lowered in the shore end, until it finally assumed the same level in both shafts, and by pumping from one shaft the water was lowered in both, after putting an additional pump in each shaft the water was soon pumped out. A difficulty that had been anticipated now presented itself, by trials made with safety lamps, the lake section of the tunnel was found to be filled with gas, and as its connection with the shaft was 25 feet lower than the summit where the gas entered, it was found to be impossible to blow it out or to sufficiently dilute it with common atmosphere to render it harmless, the blower was worked continuously at its highest speed for several days, but without the desired effect. The air pipe was then disconnected at a short distance in from the shaft and the blower worked for a short time when it was found that for a distance of 100 feet or more beyond where the pipe had been uncoupled the air was good, the pipe was disconnected again just back of the gas and connected where formerly disconnected and the blower worked until another short section had been freed from gas, in this manner the workmen proceeded, clearing short sections at a time until the gas was driven out or so mixed with air as to be non-explosive. The volume of gas from this time seemed to decrease and no more trouble was experienced from it in the lake section, although it would accumulate in a thin sheet along the roof at the summit, and as the workmen usually carried their lamps hooked into the fronts of their caps, slight explosions were not uncommon when they were passing through it, the only injury resulting, being the singeing of their hair and whiskers, but they soon learned by running a car a few times past the summit after the air had been at rest for a short time that the gas would be dispelled. While the gas was being disposed of in the lake section the water was being pumped out of the shore end, so that when work could be resumed in the tunnel again with safety, the water all flowed towards the shore shaft, leaving the space intervening between the two sections of tunnel dry. About 50 feet of the tunnel, from the end back, was half filled with sand, with this exception no damage was

done by the blowing in of the clay, and the flowing of water; the work was found to be in perfect condition. On the second day after resuming work the iron invert mould that had been used in forming the bottom of the tunnel in the shore section was found standing where it was set ready for laying out the brick-work by two and one-half years before. A little farther on an iron mortar box partly filled with mortar now hardened to stone, a few scattered brick lying upon an unfinished invert, and some of the tools used by the masons and miners were found, beyond this again the invert was complete but the arch had not been turned. On the following day the two sections were joined, and the connection completed, the difference in elevation of the two lines being less than one inch. From the connection towards shore the tunnel was filled with sand to a point south of where the leak happened that caused the abandonment of the work in the shore section, as this was removed the cars, brick, cement and other material left in the abandoned tunnel were found.

At a distance of 500 feet towards shore from the connection, and a short distance from the large leak before mentioned, cracks were found in the masonry crosswise of the tunnel. A little farther on the cracks were open, and the masonry had settled. Thirty feet beyond, where the first cracks were found, the entire masonry had settled fully five feet. It had broken off in short sections and had gone down bodily, retaining its cylindrical form. An attempt was made to rebuild the tunnel through the broken part, starting the new masonry on the old bottom and building up solid brick work to the proper grade line, In this manner fourteen feet was rebuilt, but cracks similar to the old ones appearing in the new work, the attempt was abandoned, and the tunnel closed near the cracks by a brick bulkhead. In the shore section another party of workmen had been engaged in cleaning out sand, and had reached a distance of half a mile from the shaft when farther progress become impossible on account of the large quantity of sand carried in by the stream of water constantly flowing from the spring, and the heavy flow of gas that frequently drove the workmen out for several days at a time. The

large quantity of sand continually pouring into the tunnel with the water accounted for the sinking of the masonry beyond the spring, and to stop the outpouring of sand another bulkhead was built as far in towards the spring as possible. Through this bulkhead and near the top of the tunnel, a four inch cast iron pipe was laid for the purpose of giving vent to the gas and water. To the end of this pipe leading into the tunnel a tee pipe was attached, the lower branch of which was continued downward to near the bottom of a small tank into which the water flowed, forming a trap to prevent the gas from escaping into the tunnel. To the top branch of the tee a tight tin pipe was connected and extended along the tunnel to the shore shaft, and thence out into the open air. The gas all passed out through this pipe, and was discharged outside of the buildings. At first the contractor tried to make use of the gas by burning it in the furnace under the boilers and in a stove, but the intense heat warped the iron so badly in a few days that the pipe was disconnected and extended outside of the building and the gas set on fire, where it continued to burn until the work was finished and the pipe plugged at the bulkhead.

The workmen were never afterward troubled with gas and the flow of sand ceased entirely. The two bulk-heads were 832 feet apart and it became necessary to abandon that length of completed tunnel and connect the two sections by building a new piece of tunnel around the spring.

The broken piece of tunnel in settling inclined towards the east, the side where the water first appeared, and in building the connecting piece of tunnel the line was carried about 73 feet west and parallel to the old line; the clay on this line was all that could be desired and the two sections were soon connected again. To avoid as much as possible any loss in discharge on account of friction at the several curves, the face of the brick work at each of them was covered with a thin coat of cement mortar of just sufficient thickness to even up the inequalities of surface, this made a very smooth surface for the flow of water and added materially to the strength of the work. Several other places in the tunnel where bad ground had been passed were coated in the

same manner. The tunnel was originally designed to run in a straight line between the two shafts, but for reasons already mentioned several curves had to be introduced, the lines between which were straight and parallel to the original line. The point of connection was at one of these curves, so that there was no danger of the ends lapping each other in coming together. If the original plan had been carried out, it was designed to sink a pipe from the surface line down to the tunnel at about 300 feet from the shore shaft, and plumb down from the surface, giving a line of that length to project the line of the tunnel from, but before that had been done it became necessary to deviate from a straight course, and in doing so an opportunity was afforded to make the connection at an angle, and to avoid the expense and risk of sinking and protecting a tube in the lake. It was then determined to use as a line to project the tunnel from as long a line as could be obtained by plumbing down the shaft, the line thus obtained was only 7 feet and 4 inches long, and was plumbed down from the surface to the bottom of the tunnel, a distance of 76 feet, the length of tunnel built from this line was 3952 feet.

At the lake end a line 13 feet and 6 inches in length was obtained to work from, by plumbing down the shaft a distance of 110 feet, and down a tube driven from the surface through the arch of the tunnel just back of the shaft, from this line about 2700 feet of tunnel was built. When the connection was made the two lines were found to be 5 feet and 7 inches nearer together, measured at right angles, than they should have been, but when the insignificant length of the lines worked from the depth to which they were transferred, and the number of angles are considered the result was no worse than might have been expected, as the connection was made at an angle the error was of no consequence to the work.

The tunnel, from the shore shaft to the point where the connection was made, was built on an ascending grade, the elevation at the outer end being  $2\frac{1}{2}$  feet greater than at the shaft, the plan being to continue an ascending grade to the inlet shaft, but the soft material met with in sinking the inlet shaft prevented the carrying out of this plan, and the tunnel had to be commenced

at a greater depth, as already stated, than the shore end, forming at the point of connection a summit elevated above the bottom of the shore end just half the diameter of the tunnel. To dispose of the air that would naturally accumulate at this summit and prevent the tunnel from filling, a  $\frac{3}{4}$  inch gas pipe was extended along the top of the arch from the highest point to the inlet shaft and thence to the floor of the crib.

To facilitate the movement of materials out of and into the tunnel a rail track was laid through its entire length; the cars used held about 20 cubic feet of clay each or 400 brick, and in the shore section were drawn by small mules. At distances about 1,100 feet apart, the tunnel was enlarged to 6 feet 4 inches diameter for a distance of 50 feet to 60 feet. This enlargement allowed the laying down of two tracks, and gave just sufficient room to pass two trains of cars. The custom was in removing material from the tunnel to make up a train on the turnout nearest the face of the work, the workmen pushing a full car from the face to the turnout and returning with an empty one. As soon as enough cars had been filled to make up a train they were hauled to the shaft by a mule and then raised by an elevator in the shaft to the surface. In taking materials into the tunnel the train of cars was drawn to the outer turnout by the mule, and from there the cars were pushed to the face one at a time, as needed by the workmen. The cement and sand for the mortar were mixed dry, in equal parts, and sent in bags to the face, when water was added as the mortar was needed. The water used was conveyed down the shaft and along the tunnel to the face through a gas pipe, which was extended as the work advanced. The average progress made per day when no extraordinary interruption occurred was  $9\frac{9}{10}$  feet. The monthly average for 20 months was  $295\frac{8}{10}$  feet.

The greatest length built in one month was 423 feet, and during one week  $111\frac{9}{10}$  feet was completed. All of these averages and distances are for work done in one section of the tunnel.

For the purpose of ventilating the tunnel an 8 inch tin pipe was extended down each shaft and out through the tunnel to the face. Air was forced through these pipes by blowers driven

by separate engines and so long as the joints in the pipes could be kept tight the air in any part of the tunnel was good; for a part of the distance, wooden box pipes were used but they were soon removed as it was found impossible to keep the joints tight and tin pipes substituted.

Many items of interest were noted during the time the work was in progress, one of these was the discovery of what appeared to be the channel of an old water course, probably the ancient outlet for a stream draining a valley very similar in outline to the Cuyahoga Valley. This channel is now filled with soft clay and is from 60 to 80 feet below the present bed of the Cuyahoga river. It was twice crossed by the shore section of the tunnel, and was followed for some distance by the lake section, the crib resting partly upon it.

In making the preliminary borings care was taken to keep away from the proposed line of tunnel and the different borings were made alternately upon opposite sides of the line and about 150 feet from it, the object being to ascertain the general character of the ground, this was found to be so uniformly good in all the places tried that the presence of any unfavorable material was never suspected until the soft clay was entered.

The workmen were at one time very much alarmed by a moving mass of ice striking and breaking upon stationary ice nearly over where they were working. they supposed it had grounded and was ploughing up the clay over them, and from the loud noise made, believed that the tunnel could not be more than 5 feet below the water, some of them started for the shaft but were stopped by the foreman and persuaded to return to their work and he finally succeeded in convincing them that there was not less than 30 feet of clay over any part of the tunnel.

Subsequently the surveying party had an opportunity of listening to the noise made by the passage of a steam barge and a large raft of logs, the puffing of steam, the turning of the wheel in the water, the rattling of the chains binding the logs together, and the noise made by the logs rubbing and striking each other was as distinctly heard as if only a few feet away; the tunnel at this point was 80 feet below the surface of the lake, the thickness of



the clay being 45 feet and the distance from the shaft about 1,000 feet. On another occasion when working near the same place in the tunnel, the same party heard distinctly the falling of rain drops on the surface of the lake over them. It was only when the lake was very still and during heavy showers that it could be heard.

#### CASUALTIES.

When the shore shaft had been excavated to within four feet of its proper depth a heavy flow of gas was met with coming up from the bottom, carrying with it just enough water to indicate by its bubbling the presence of gas. This happened on a Saturday evening just as the men were quitting work. On the following Monday morning Thomas Jackson, the foreman, and James Cribbens, a miner, started to go down the shaft in a bucket. When about half way down Jackson struck a match, causing a fearful explosion of the gas, that threw Cribbens out of the bucket to the bottom of the shaft, a distance of nearly 40 feet, and set fire to the clothing of both of them. Jackson afterwards descended to the bottom of the shaft and brought Cribbens up, though fatally burned himself. The next morning Cribbens died from injury to the spine. Jackson lingered for a little over two weeks, when he died from the effect of his burns. Two other men who were standing near the shaft were severely though not dangerously burned. Both of them soon recovered. One of these men had a most miraculous escape from death. At the time of the explosion he was standing on a plank that lay across the edge of the shaft, and was blown up about 12 feet. Before falling again, a plank from a dump platform overhead fell across the shaft directly under him, upon which he fell, alighting in such a position that he could cling to it and save himself from falling to the bottom of the shaft.

Jackson was an old miner, and had worked from boyhood in English coal mines. He was fully aware of the fatal consequences that would result from setting fire to the gas, and frequently cautioned the men working for him not to smoke in the shaft. He said before he died that he could not account for his rash act, knowing as he did that the shaft was filled with gas.

William English, a laborer on the crib during its erection in the lake, fell from the top of the wall, striking his head on the edge of a lighter that lay alongside, fracturing his skull, from the effects of which he died in a few hours.

James Charters, a topman at the crib, whose work was to dump the earth from the cars into the lake, disappeared, unseen by any one, and is supposed to have fallen off the crib. The bottom of the lake at the opening in the crib was dragged, but his body was never found. Three men were drowned at different times while going from shore to the crib in small boats—namely, Charles Hampson, bricklayer, drowned by upsetting of boat near shore; James Sullivan, laborer, fell out of a boat while going to the crib in tow of a tug; Michael Coyle, laborer, jumped overboard to recover an oar, disappeared before the others in the boat could reach him.

While it is deeply regretted that the lives of any of the workmen employed should have been sacrificed, it is due to the contractor to state that no injury was done to any one on account of carelessness or want of proper precaution on his part or that of his agents, or from the failure of any of the fixtures or appliances furnished by him for doing the work. On the 18th of January, 1871, the engine house and buildings at the shore shaft were burned down, and the machinery badly injured, causing considerable delay and a heavy loss to the contractor.

Immediately after the explosion in the lake section of the tunnel, Mr. Joseph McDonell, a brother of the contractor, and superintendent of the work for him; in company with George Dennon, foreman; started into the tunnel to ascertain the extent of the damage and to learn whether it would be possible to continue the work. Before starting they tried to trim and put in order a safety lamp, kept for use in just such emergencies, but could not get it to work to their satisfaction, and so started with open lights. When they had reached a distance of 2,400 feet from the shaft their lights came in contact with the gas, causing three distinct and separate explosions, following each other in quick succession. These explosions were indicated on the crib by clouds of dust and rubbish being thrown up, and by the lifting

of the cage in the shaft. The lights carried by the two men were, of course, blown out, and they were obliged to grope their way back, nearly a half mile, in the dark, to the crib. When they were brought to the surface they were found to be severely burned, not only on the exposed parts of the bodies, but on their backs, shoulders and arms by the burning of their clothing. They suffered intensely from their injuries for several weeks, but with skillful treatment recovered and worked in the tunnel until it was completed.

The contractor, A. A. McDonell, is deserving of the highest praise for his energy and determination to overcome all difficulties, and for the faithful, substantial and satisfactory manner in which he executed a work demanding at all times the utmost care and watchfulness. The faithful manner in which Joseph McDonell carried out the directions given him, and the courage and perseverance displayed under the many and trying difficulties and dangers attending the work, merited and received the commendation of your Board. The Messrs. Delamater, contractors for building and placing the crib in position, completed their work in a manner creditable to themselves and acceptable to the city.

Before the plans were prepared, T. R. Scowden, hydraulic engineer, then of this city, was appointed consulting engineer, which position he filled until the work was well advanced. While the plans were being prepared he was frequently called upon for advice, and upon their completion gave them his approval.

Through the kindness and courtesy of Mr. Chesbrough, City Engineer of Chicago, your engineer had ready access to the plans, estimates and other papers relating to the tunnel at that city; and also received from him information and advice that was of great service in the prosecution of the work. The favors so generously and freely extended are hereby gratefully acknowledged.

In the annual report to your Board for the year ending April 1st, 1869, an estimate of the cost of the proposed tunnel was presented, amounting to a total sum of \$325,000.00. This sum in-

cluded every item of cost to complete the tunnel and make the connections with the old aqueduct. The work has all been done as contemplated and the expenditures have been as follows :

Tunnel.....	\$178,237 94
Lake crib, including dwelling, lighthouse and stone outside.....	109,666 63
Lake shore shaft.....	7,678 06
Inlet shaft in lake.....	10,308 69
Connecting with old aqueduct at lake shore and new engine house, including gate wells.....	10,097 76
Inlet extension ac't., including all incidental expenses.....	9,362 64

Total cost.....\$320,351 72

The following communication giving the result of comparisons of the quality of the water furnished by the city before and after the completion of the lake tunnel shows a most gratifying improvement since the supply has been drawn from that source, and that the water now furnished is exceptionally pure.

CLEVELAND, Jan. 26th, 1875.

*John Whitelaw, Superintendent and Engineer of Water Works.*

SIR:—A comparison of the amount of solid matter dissolved and suspended in the water supplied to the city before and after the completion of the lake tunnel, shows that the quality of the water has been greatly improved. In November 1873, before the opening of the tunnel, the amount as determined in a sample of water drawn at the Cleveland Medical College, was 240 parts in a million. In November 1874, after the opening of the tunnel, in a similar state of winds, weather and other circumstances, the amount was but 131 parts in a million.

That the water has been more clear and limpid is a matter of common observation, the amount of suspended matter has therefore decreased in an important degree. In November 1873 this amount was 110 parts in a million. In November, 1874, it was but 12 parts in a million. It is not affirmed that the ratio of these numbers is an accurate measure of the improvement; such a measure could be obtained only by accumulating observations through a series of years, but it is a proof that the improvement has been great. The freedom of the water from a disagreeable odor or taste is a matter in respect to which the public do not need to appeal to the chemist.

Organic matter is the most injurious impurity of a potable water. Such matter is contained in all water flowing over a

fertile soil. When water accumulates in rivers, these organic matters are gradually oxidized and destroyed by the action of atmospheric oxygen dissolved in the water. If sufficient time be allowed after the last contamination, and if the motion of the water expose fresh surfaces to absorb oxygen from the air, organic impurities may be so consumed as to give no longer any occasion for uneasiness.

At the mouth of the Cuyahoga river this process is not complete, and its waters mingling with the waters of the lake, which has been purified by long exposure to the air, introduced organic matter into the supply of the city. In November, 1873, a test known to chemists as the permanganate test distinctly showed in five minutes the presence of organic impurity. But in November, 1874, after the supply began to be drawn at a greater distance from the mouth of the river, the same test, all the circumstances being the same as in the previous experiment, failed to show as distinctly, even in two hours, the presence of easily oxidizable organic matter. In its relations to the public health, this is a most important advantage arising from the now completed improvements of our Water Works. We may now congratulate ourselves on the possession of a water supply of a quality which leaves nothing to be desired.

EDWARD W. MORLEY,

*Prof. of Chemistry, Cleveland Medical College.*

It is not claimed that the water furnished through the tunnel will at all times be clear and colorless, for it is well known that during the spring and fall months the water in the lake is frequently colored by the clay washed from the banks and stirred up from the bottom near the shore for miles beyond the inlet to the tunnel. Such coloring matter, however, being nothing but pure clay, is harmless, and the quantity suspended in the water is so small that it simply gives it a slightly opalescent appearance, even during long continued storms; but it is claimed that the water now furnished is free from those objectionable organic impurities discharged into the lake by the river and sewers, and that were drawn through our old inlet and rendered the water formerly supplied so impure and disagreeable.

The following table gives the temperatures of the water for the ten months following the opening of the tunnel, and for the corresponding months during the two years preceding that event.

TABLE

Showing the average temperatures of lake water for the following months in the years 1872, 1873 and 1874:

MONTHS.	YEARS.		
	1872.	1873.	1874.
March.....	32°.07	32°.00	33°.66
April.....	46°.46	42°.06	37°.69
May.....	50°.22	53°.06	49°.20
June.....	54°.30	66°.58	63°.53
July.....	70°.90	74°.93	70°.38
August.....	77°.03	74°.10	68°.74
September.....	69°.86	68°.36	69°.28
October.....	55°.87	57°.06	50°.25
November.....	42°.10	39°.40	46°.06
December.....	32°.00	35°.65	34°.34

The illustrations accompanying this report were drawn by Mr. John Carnegie, who also superintended the building of the crib and prepared the detail drawings for the same, and was architect for the new engine house.

Respectfully submitted,

JOHN WHITELAW,  
Superintendent and Engineer.

CLEVELAND, O., February 27th, 1875.

## WATER WORKS PUMPING DEPARTMENT, January 1, 1875.

*To the Trustees of Water Works:*

GENTLEMEN:—In accordance with the duty devolving upon me, I herewith submit a report upon the condition of the pumping machinery of the Water Works, with the amount of work done, and the repairs and improvements during the past year.

January 1st, at 7 o'clock a. m. but one foot in depth of water was in the reservoir, but in the afternoon the ice trouble began to disappear, and on the following morning there was water enough to supply both pumps, and the reservoir was soon again filled with water to its maximum level.

On the second day of March at 2 p. m. both engines were stopped for the purpose of opening the new aqueduct and making connection with the old aqueduct at the lake shore; after a stoppage of six hours and twenty minutes both engines were again started to pump, and on the following day between the hours of 5 and 6 p. m. the water was flowing through the lake tunnel in to the pump wells, and pumped to the reservoir.

On the 1st of April, at 6:50 p. m., the west engine was stopped by the breaking of the gibs in the main pump cap connection of the west engine, which were replaced by a duplicate set. On the 28th of June both engines were stopped for the purpose of opening the old aqueduct into the new one leading to the pump wells of the new engines.

On the 13th of July at 6:15 p. m. the west engine was stopped, caused by the fracturing of the lower valve chamber of the main pump; the said fractured part was repaired with a forged iron plate well fitted and bolted.

On the 18th of August soon after the west engine was set to work the gibs of the upper end of the air pump rod broke at the same time bending the strap, but no other damage was done; the said strap was repaired and a new set of gibs and key made for the same, repairs being made as soon as possible.

The average depth of water in the reservoir for the year was eighteen and seven tenths (18 7-10) feet.

The engines worked during the year five hundred and sixty nine (569) days, the average running time per day being nineteen hours and forty one minutes, a per diem increase of fifty one minutes.

Number of strokes made by the east engine.....	2,621,650
Number of strokes made by the west engine.....	2,541,675

Total.....	5,163,325
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The average height above surface of lake to which water was pumped, one hundred and fifty seven and four tenths (157 4-10) feet.

Duty of the east engine.....	39, 980.202
Duty of the west engine.....	40,079,125

pounds of water raised one foot high with each one hundred pounds of coal consumed in raising steam and pumping, the coal used being bituminous slack somewhat mixed with nut coal.

The pumps are working against a main pipe friction head of water of six feet six inches in the stand pipe, which is not taken into consideration in making up the duty of the engines.

The following represents the number of gallons of water pumped by the Duplex engines.

During the month of July.....	36,774,562 gals.
During the month of August.....	77,239,722 "
During the month of September, .....	59,482,892 "
During the month of October.....	174,493,067 "
During the month of November.....	43,802,577 "

Total number of gallons of water pumped, 391,792,820 "
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The following are the repairs and improvements made during the year:

Repaired the valve gear catch quadrants of both engines by fitting them with steel face pieces fastened with steel bolts, so that they can be replaced at any time with others. Put new rubber head valve in the air pump, and new bolts in the valve seat of the east engine; new brass valve in the cold water pump of east engine.

Put new valve and valve seat in the lower chamber of the west main pump and new bolts in valve seat. Overhauled the back connection feed pipes of both east and west boilers, put new joint bolts in the same and refitted the gauge cocks of the said boilers. Cleaned the back main flues between the boilers and smokestack and repaired brick work of flues and about the boilers.



Put new screen frames with new copper wire screens in the pump wells of both engines. Made new screen frame for the gate house screen. Overhauled all the windows in the engine and boiler rooms and tower; repaired the wood work of the same and put them in good repair and painted them with one coat of good paint. Also repaired the front doors, and painted them with two coats of good paint.

The engines, pumps and boilers are in good working order, but the renewal of the east main pump valves, and the steam valves and valve rods of both engines are needed as soon as it can be done; also the lower valve chamber of the west main pump, and the cold water cisterns of both engines. It is necessary, also, that a new coal bin be built for the east boilers.

Fires were lit in the new boilers on the 20th of June, for the purpose of testing the joints of the boiler connections and steam pipes, steam was raised to a pressure of 35 pounds per square inch, and the said boilers and their connections proved to be all right and ready for service.

July 1st steam was let into the steam cylinders to test the joints and details of the same, and for the purpose of starting the engines if everything proved all right.

On the 13th of July, soon after the fracture occurred in the valve chamber of the west main pump, I made this known to Mr. Holloway, who willingly offered the use of the new Engines and furnished men to run and care for them. They were started at 9 p. m. of the same day and were kept in use up to 6 p. m. of the 23d of July, the time being nearly ten days of 24 hours per day

The following work has been done for the new works:

Made two new screen frames and fitted with new copper wire screens for the new aqueduct near the pump well of the new engines. Fitted up the woodwork for the wash rooms and closets for both engine and fire-rooms. Fitted up the two large doorways between the engine and boiler rooms, with brick work and wood work, forming the lower part into tool closets and the upper part windows—and so arranged that it can all be taken away and replaced when needed.

Fitted the store-room with shelves and drawers, a stand for oil barrels and frame to form a rack for wrenches and other tools—made a good carpenter bench and vice bench for the work room. Made a good drawing table, and book case with drawers for the Engineer's room. Completed the stone work support of the main discharge pipe (of the new pumps) below the engine room floor, also the required stone cutting for the back flue walls of boilers and for gas and water pipe connections and so forth, for completing the details in finishing up the work in connection with both engine and boiler rooms.

The boilers are covered with red brick clay and coal ashes; the steam drums and pipes with boiler cement covering. The steam drums and boiler furnaces have been repaired by removing a number of rivets and re-riveting the same; the said parts showed that the plates were not drawn well together (the said work being done in cold weather) the rivets becoming too soon cold for good work.

Gas has been brought into both engine rooms and boiler rooms and is in use in both, and is found to be a great improvement and convenience.

Lamp-posts with gas lamps have been placed on the grounds between the two buildings in such manner as to light up each building on three sides, which makes it much more convenient for night work than before.

Constructed a timber and pine plank floor on the south side of the new boiler house for the storage of coal.

Built a timber and pine plank platform in the space between the steam cylinders and around the air pumps and between the said cylinders and main pump, level with Lake high water line. Laid a pine plank floor between the steam cylinders and between the main pumps.

Various other rough carpentry jobs have been done for the new works.

Put a cast iron self-adjusting support of main steam pipe in the wall between the engine and boiler rooms.

Put four inch gas pipe column with cast iron flange to support the branch piece of steam pipe in the the engine room.

I beg to recommend that the catch basin of the boiler room have a cast iron lining, and that a four inch iron pipe be laid from the boiler house to the river, the said pipe connected with the boiler blow off pipe so that the hot muddy water blown from the boilers be carried direct to the river. Also that the north and back wall of the boiler house be repaired as soon as convenient and that semi-circle brickwork be built at each flue opening in the back wall of the boiler house, so as to permit of additional filling at the said point to protect it against any lodgment of water. The annexed schedule statement gives the engine record of the year 1874. Also annexed is an inventory of tools, materials, and furniture at pumping works January 1st, 1875.

Respectfully submitted,

JOHN VIAL,  
*Engineer in Charge.*

## INVENTORY

Of Tools, Material and Furniture, at Pumping Works, January 1st, 1875.

NO.	ARTICLES.	NO.	ARTICLES.
1125	Tons of coal for Engines,	4	Arm chairs,
35	Gallons of cylinder oil,	12	Common chairs,
70	Gallons of lard oil,	3	Cupboards or closets for tools, etc.
25	Gallons of Mecca oil,	1	Book case with drawers,
15	Gallons of headlight oil,	2	Vise benches,
675	Pounds of tallow,	3	Bench vises,
200	Pounds of hemp packing,	1	Hand vise,
52	Pounds of rubber packing,	1	Small portable vise,
4	Air pump, valves of rubber,	6	Files,
2	Pieces joint and valve rubber,	22	Cold chisels,
7½	Pounds of Tappet leather,	24	Drills,
185	Feet of 2-inch leather hose,	8	Calking tools,
2	Hose Pipes,	2	Drills for boring stone,
1	Shaft for air pump connections	1	Reamer for boring stone,
2	Sets of gibs and keys for piston and pump caps,	1	Hand hammer,
1	Brass valve for cold water pump,	4	Sledges (or sledge hammers),
3	New valves for main pump,	4	Screw wrenches,
1	Valve chamber for main pump,	3	Copper hammers,
1	Stop valve chamber and valve for main pump,	3	Thermometers,
1	Set gear for the same,	275	Pounds of cotton waste,
2	Pieces of discharge pipe for main pump,	30	Pounds of white lead,
1	Blank flange for stand pipe branch,	10	Pounds of red lead,
14	Brass hand lamps,	2	Gallons of linseed oil,
5	Globe lanterns,	½	Barrel soft soap,
1	Square lantern,	50	Feet of ½-inch rubber hose,
8	Brass oil cans,	1	Hand pump of galvanized iron,
7	Tin oil cans,	5	Coal wheelbarrows,
1	Three-gallon tin measure,	1	Carpenter's work bench,
2	One-gallon tin measures,	1	Hand Saw,
2	One-quart tin measures,	1	Jack plane,
2	Tin funnels,	1	Moulding plane,
2	Tin tallow kettles,	1	Two-inch chisel,
1	Tallow kettle and furnace,	1	One and one-half-inch gouge,
5	Stoves,	1	Iron square,
3	Coal scuttles,	1	Hand brace,
2	Stove shovels,	7	Bits for ditto,
1	Knife frame and knife,	1	Hand axe,
2	Knives, common,	1	Club axe,
4	Engine record books,	1	Oil stone,
1	Engine indicator (complete),	2	Pairs of compasses,
2	Writing desks,	1	Pair of calipers,
1	Writing desk stand,	1	Grindstone,
2	Drawing tables,	1	Drilling machine,
4	Common tables,	1	Hand drill brace (geared),
		7	Bits for the same,
		2	Screw drivers.
		1	1½-inch screw tap,
		1	1½-inch screw tap,

## INVENTORY—(Continued).

NO.	ARTICLES.	NO.	ARTICLES.
2	1½-inch screw taps,	26	Fathoms of 3-inch rope,
2	1-inch screw taps,	22	Fathoms of 3-inch rope,
2	¾-inch screw taps,	9	Fathoms of 2½-inch rope,
1	¾-inch screw tap,	39	Fathoms of 4½-inch rope,
1	Stocks, 4 pairs of dies,	15	Fathoms of 4½-inch rope,
1	Stocks, 1 pair of dies,	26	Fathoms of 3½-inch rope,
1	Stocks, 2 pairs of dies,	28	Fathoms of 3½-inch rope,
7	Small taps for ditto,	66	Fathoms of 6-inch rope,
8	Tap Wrenches,	10	Fathoms of 3-inch rope,
1	Ratchet drill brace,	11	Fathoms of 3½-inch rope,
6	Socket wrenches,	13	Fathoms of 3½-inch rope,
5	Claw wrenches,	2	Rope lockers,
22	Common wrenches,	2	Pine way timbers, 12x12,
2	Key wrenches,	3	Pine timbers, 8x8, 30 ft. long,
3	Valve or gate wrenches,	2	Pairs of short sheer timbers,
1	Drill post,	200	Feet of ½-inch iron chain,
2	Pairs gas pipe tongs,	1	Lead ladle,
1	Blacksmith forge,	1	Set of ½-inch steel figure
2	Blacksmith anvils,		stamps,
6	Pairs blacksmith tongs,	1	Platform scales (600 pounds),
3	Blacksmith chisels,	1	Steelyard scales (2000 pounds),
2	Pairs blacksmith swages,	209	3½ feet furnace grate bars,
1	Blacksmith flattening tool,	260	Fire brick,
11	Pairs of eye bolts,	3	Barrels fire clay.
142	Bolts and nuts for pump work,		<i>Out of use (oil lamps.)</i>
2	Screws for raising pump valves	2	Chandeliers,
1	Lifting screw, complete,	2	Bracket Lamps,
1	Ratchet lever for the same,	1	Table lamp,
1	Hack saw	3	Boiler room lamps,
1	Crab winch, double geared,	2	Brass valves of cold water
1	Pair 13-inch blocks,		pump,
2	Pairs of 9-inch blocks,	1200	Pounds of cast iron scrap,
1	Pair of 8-inch blocks,	1	Stop valve chamber of main
1	Pair of 6-inch blocks,		pump,
2	Single 17-inch blocks,	1	Piece of discharge pipe.
1	Single 14-inch block,		
19	Fathoms of 3-inch rope,		

## SCHEDULE

Showing the Miscellaneous Material at and around the Engine Houses December 31, 1874.

NO.	ARTICLES.	NO.	ARTICLES.
4	Hand derricks without gearing,	2	Sections of tunnel shaft,
2	Large derricks with gearing,	2	30-inch flange curves,
9	Wheelbarrows,	1	Piece of 20-inch pipe 7 ft. long,
1	Well pulley,	1	Centrifugal pump and fixtures,
1	Double block,	1	Pony engine and fixtures,
3	Mauls,	2	36-inch pipes,
1	Scoop,	4	36-inch sleeves,
1	Melting ladle,	1	30-inch sleeve,
2	Caps for sheet piling,	2	24-inch sleeves,
4	Eyebolts for gate well covers,	1	30 inch curve,
24	Sections of aqueduct gates,	1	30-inch to 24-inch reducer,
1	Pair of iron pulley blocks,	2	Crowbars,
1	30-inch valve, worn out,		

## SCHEDULE

Showing the Miscellaneous Stock and Material on hand at the Reservoir.

NO.	ARTICLES.	NO.	ARTICLES.
1	30-inch wrench,	1	36-inch pipe 8 ft. long,
1	6-inch wrench,	1	30-inch pipe 8 ft. long,
1	20-inch wrench,	5	30-inch pipes,
2	16 inch sleeves,	3	30-inch pipe 3 ft. long,
4	10-inch sleeves,	8	24-inch pipes,
1	8-inch sleeve,	1	24-inch pipe 10 ft. long,
2	20-inch sleeves,	1	24-inch pipe 8 ft. long,
2	24-inch sleeves,	3	10 inch pipes,
4	30-inch sleeves,	2	12-inch pipes,
2	Pairs 30-inch clamps,	5	8-inch pipes,
3	Pairs 36-inch clamps,	2	8-inch pipes 9 ft. long,
4	Pairs 24 inch clamps,		20 ft. of 10-inch pipe,
2	Pairs 20-inch clamps,	2	20-inch pipes,
5	Pairs 16 inch clamps,	1	16-inch pipe,
2	Pairs 20-inch socket clamps,		36 ft. of 8-inch pipe in pieces
1	Pair 16-inch socket clamps,		from 5 to 8 ft. long,
2	Pairs 24-inch socket clamps,		159 ft. of 6-inch pipe in pieces
4	Pairs 6-inch clamps,		from 4 to 10 ft. long,
2	Pairs 4-inch clamps,		166 feet of 4-inch pipe in pieces
3	Pairs 8-inch clamps,		about 8 ft. long,
1	20 inch cap,	13	6-inch pipe,
1	16-inch cap,	1	4-inch pipe,
1	30-inch cap,	1	24-inch valve,
2	30-inch curves,	1	24-inch valve (Scowden's.),
3	30-inch $\frac{1}{2}$ curves,	2	20-inch valves (Scowden's.),
6	16-inch curves,	1	8-inch valve,
2	8-inch curves,	1	4-inch valve,
2	4-inch curves,	1	3-inch valve,
1	3-inch curve,	2	Furnaces for melting lead,
1	3-inch elbow,	2	Lead pots,
1	12-inch cross,	3	Melting ladles,
2	8-inch crosses,	1	set of calking tools,
3	6-inch crosses,	1	Tool box,
2	4-inch crosses,	3	Pails,
4	4-inch cement crosses,	1	Grindstone,
3	4-inch cement tees,	4	Hods,
1	10-inch tee,	2	Scythes,
4	6-inch tees,	1	Sickle,
1	8-inch tee,	5	Hoes,
1	6-inch sprinkler tee,	1	Hay rake,
1	36-inch to 24-inch reducer,	1	Lawn Mower,
1	10-inch to 3-inch reducer,	1	Monkey wrench,
3	12-inch to 6-inch reducer,	1	Manure fork,
1	4-inch to 3-inch reducer,	2	Lamp posts,
1	24-inch to 20-inch reducer,	35	Tons, estimated, scrap iron
9	36-inch pipe,		

## SCHEDULE

Showing the miscellaneous stock and material on hand at the Store Room.

NO.	ARTICLES.	NO.	ARTICLES.
1	8-inch tee,	25	Pounds white lead,
1	8-inch to 4-inch tee,	8	Yards duck cloth,
2	6-inch tees,	8	Oil cans,
2	4-inch tees,	5	Street lamps,
3	8-inch sprinkler tees,	110	Pounds of packing,
3	8-inch curves,	2	Sledges,
7	6-inch curves,	2	Axes,
7	6-inch elbows,	1	Saw,
1	4-inch crosses,	4	Hammers,
1	8-inch pipe,	300	Pounds of lead,
14	feet of 8-inch pipe,	2	Crow bars,
2	6-inch pipe,	28	Picks,
	23 ft. 6-inch pipe in pieces,	21	Pounds of rubber gaskets for
3	12-inch pipes,		fire hydrants,
3	4-inch pipes,	1	Double block (pulley,)
4	3-inch pipes,	1	Set of double pulley blocks
	73 ft. of 3-inch pipe in pieces		with rope,
	4 to 10 ft.	2	Sets of chains for pipe laying,
4	cyl. valve boxes,	1	Ladder,
4	valve boxes,	1	Derrick for test pits,
2	10-inch to 6-inch reducers,	116	Ft. of pipe drill rods for test
1	8-inch to 4-inch reducers,		pits,
8	6-inch to 4-inch reducers,	7	Globe valves,
7	4-inch to 3-inch reducers,	1	Pair tongs,
12	4-inch elbows,	2	Sprinkler boxes,
2	3-inch elbows,	5	Sprinkler box covers,
1	3-inch curve,	6	2-inch nipples,
5	4-inch sprinkler tees,	4	2-inch couplings,
6	6-inch sprinkler tees,	24	Ft. of 3-inch pipe (wrought,)
3	10-inch sleeves,	1	Drill augur for test pit,
3	8 inch sleeves,	1	Rimming augur for test pit
11	6-inch sleeves,	1	20-inch wrench,
4	3-inch sleeves,	3	6-inch wrenches,
1	4-inch sleeve,	2	16-inch wrenches,
2	Pair 12-inch clamps,	1	30-inch wrench,
3	Pair 10-inch clamps,	2	Claw wrenches,
8	3-inch valves,	4	Monkey wrenches,
10	6-inch valves,	1	Set of scales,
9	4-inch valves,	1	2 inch tin pump,
17	3-inch valves,	1	Wheel-barrow,
2	Barrels of cement,	2	Ladle rests,
1	Barrel of clay,	2	Hydrant wrenches,
13	Pails,	1	Ton of coal,
8	Fire hydrants,	1	Maul,
3	Fire hydrants out of order,	1	Barrel of brass scrap,
1	Large derrick with gearing,	2	Tape lines,
3	Furnaces for melting lead,	2	Store room sheds,
4	Melting pots,	2	3 inch water meters,
4	Melting ladles,	2	1/2 inch water meters.
3	Sets of calking tools,		



## SCHEDULE

Showing the stock, furniture, &amp;c., on hand at the office.

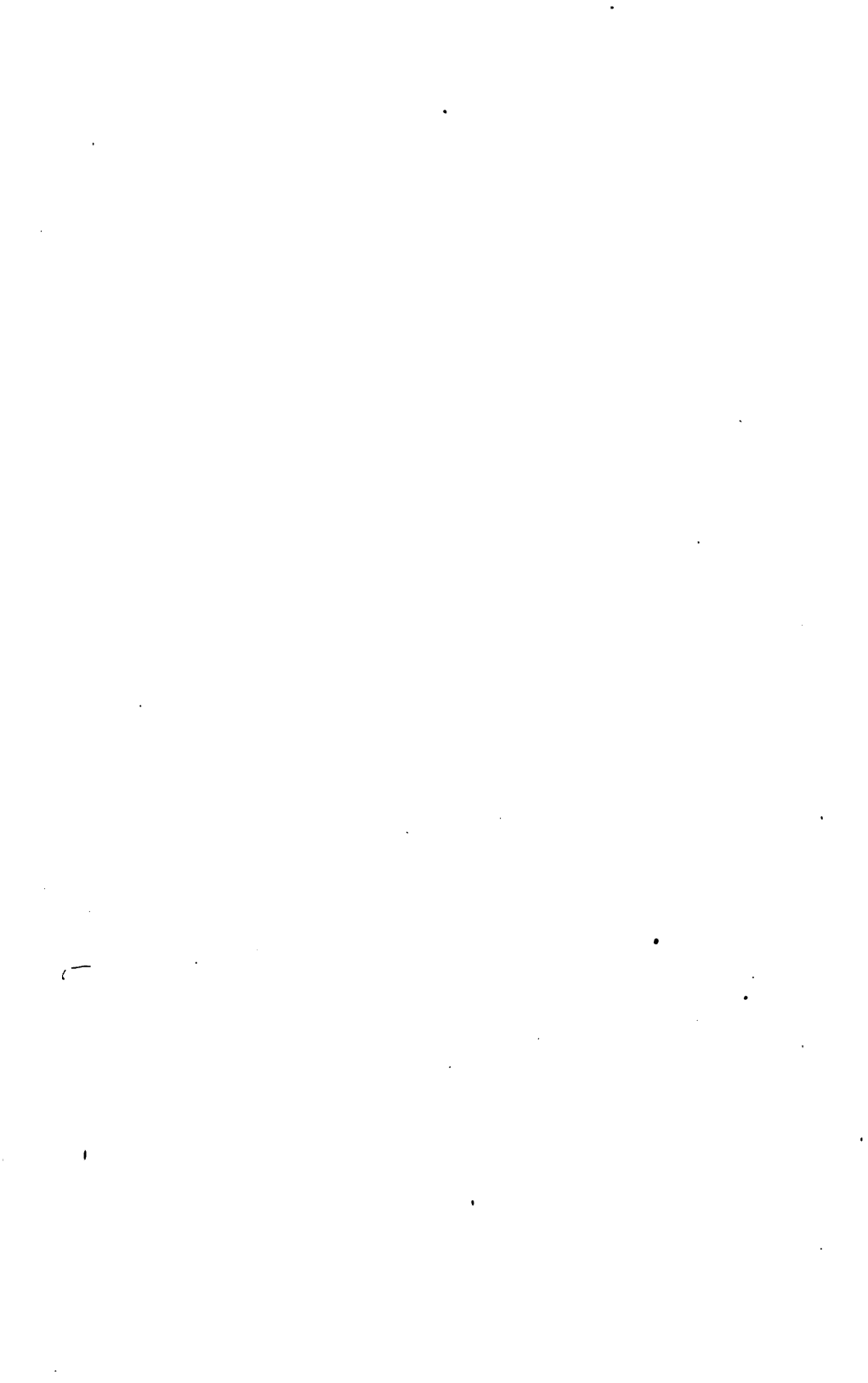
NO.	ARTICLES.	NO.	ARTICLES.
3	Desks	1	Picket,
4	Tables	2	Tape Lines,
1	Bureau for drawings,	2	Picks,
1	Safe,	1	Shovel,
1	Office counter,	1	10 inch drill clamp,
16	Chairs,	1	8 inch drill clamp,
1	Clock,	1	6 inch drill clamp,
2	Large Coal Boxes,	4	Stop cock wrenches,
1	Ton of coal,	1	4 inch wrench,
1	Drawing table,	1	6 inch wrench,
8	Drawing boards,	1	3 inch wrench,
7	Pictures, framed,	1	3 inch claw wrench,
1	Stove (base burner)	2	Pairs tongs,
58	Yards carpet,	2	Sprinkler wrenches,
131	Yards Linoleum Carpets,	1	Set of tapping tools and bag,
1	Roll drawing paper	2	Street washer keys,
4	Maps,	3	Coal scuttles,
	Plans, maps, sketches &c., of	6	Balls of twine,
	different kinds of work,	2	Pairs of rubber boots,
2	Door mats	6	Sprinkler couplings,
1	Barometer,	5	Lanterns,
1	Double gas light bracket,	1	Model of crib,
1	Double gas light chandelier.	523	Stop cock numbers,
10	Single light brackets	1	Monkey wrench,
3	Books, permit, cash and ledger	2	Fire hydrant wrenches,
1	Book, pipe record,	1	Cupboard for papers, reports
1	Letter scale,		&c.
4	Bill books,	1	Brace,
1	Transit,	14	Cement ferrules
1	Level,	200	Brass ferrules,
1	Target rod,	1	Water cooler and stand,
2	100 feet chains,	1	Pair 2 inch pipe tongs,

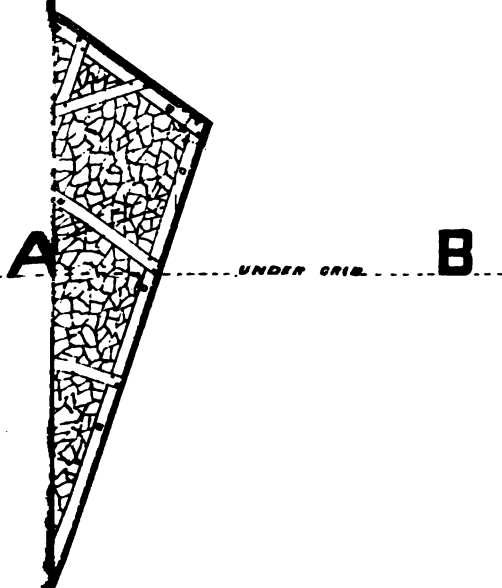
## SCHEDULE

Showing the stock and materials at the crib.

NO.	ARTICLES.	NO.	ARTICLES.
2	Sections of tunnel shaft,	1	Heavy sledge,
1	Sail and row boat,	1	Largemonkey wrench,
2	Lanterns.	1	Crow bar,
4	Oil cans,	8	Tons of coal,
1	Pair pulley blocks for boat	2	Tons of scrap iron,
	hoist,	1	25 feet flag, (stars and stripes),
1	Fresnel light of the 6th order	1	Grind-stone,
	for light house,	1	Pile ram
1	Piece of 6 inch driving pipe 8	1	Earth closet.
	feet long,		



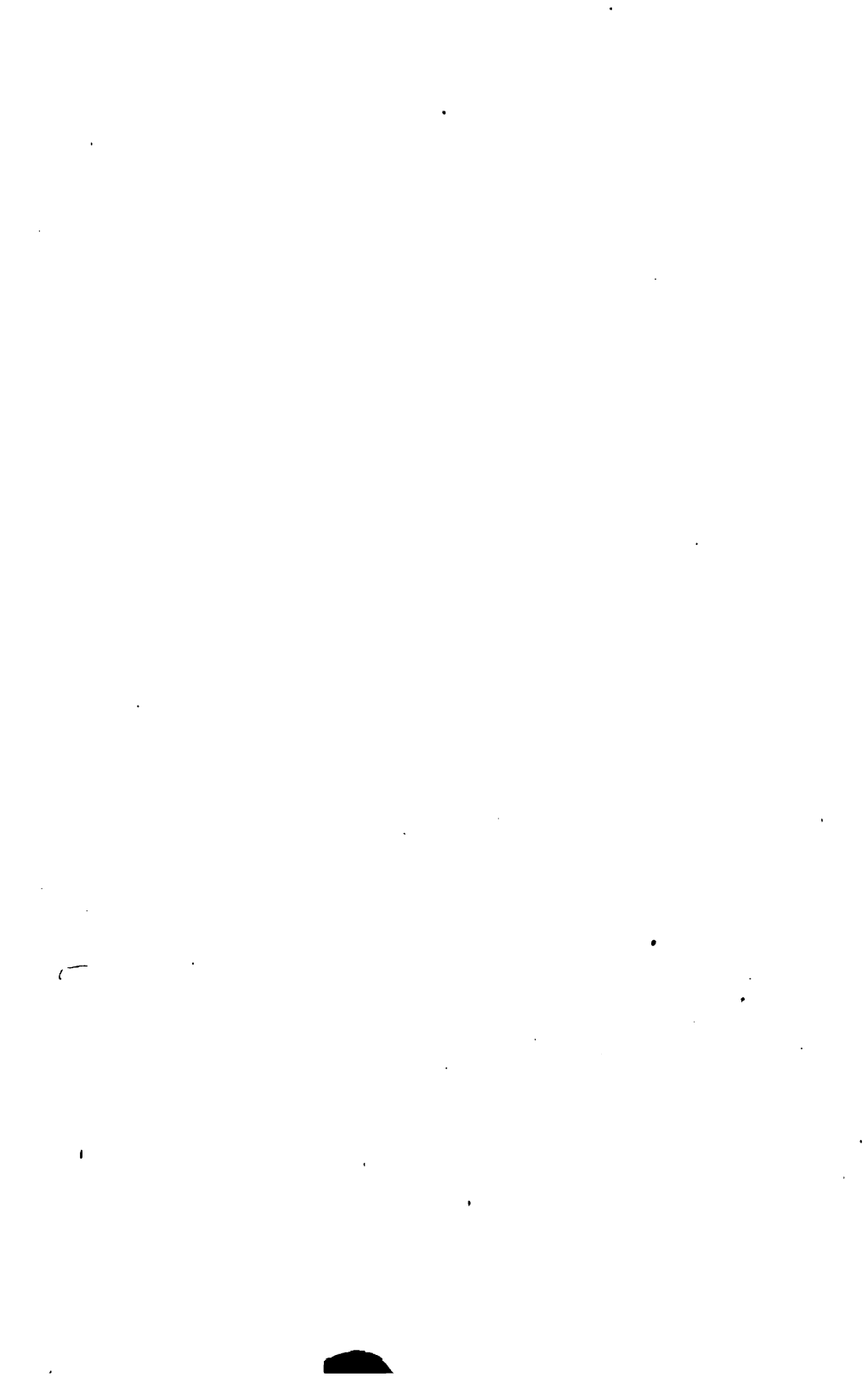


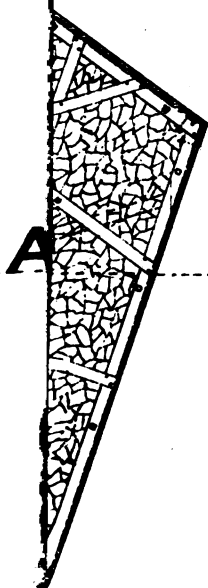


# INLETS

SCALE 10 FEET TO ONE INCH

NE





A

UNDER GRID

B

# INLETS

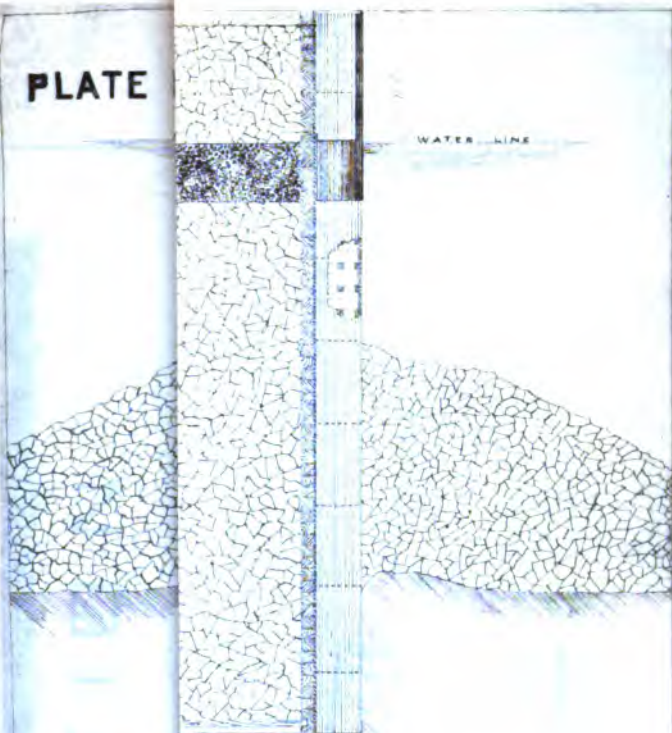
SCALE 10 FEET TO ONE INCH

NE



PLATE

WATER LINE

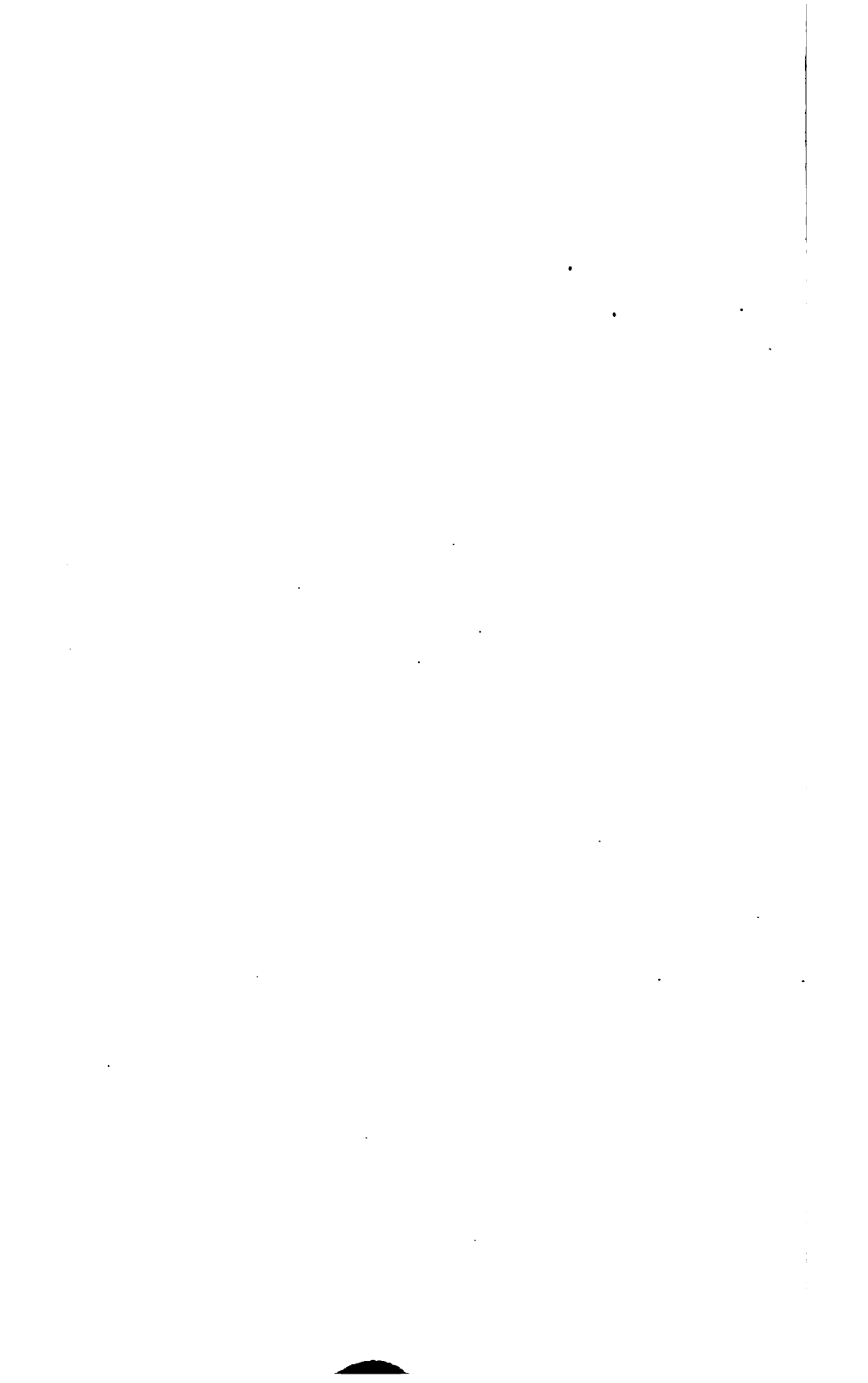


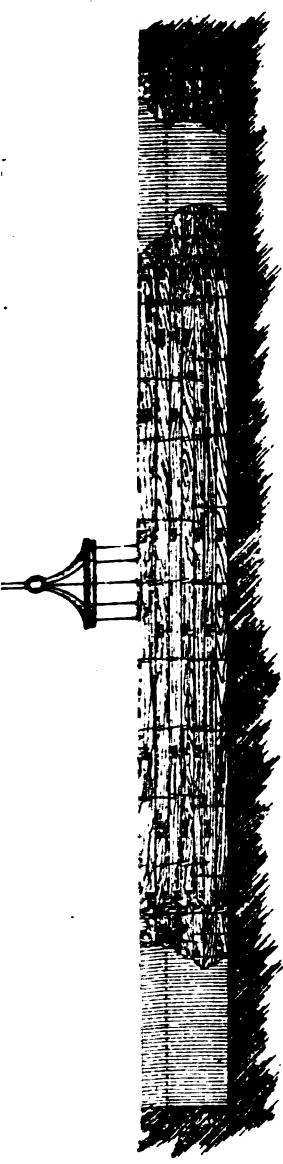
SE  
Shaft

SCALE 16 FEET TO ONE INCH

PL







# ELEVATION

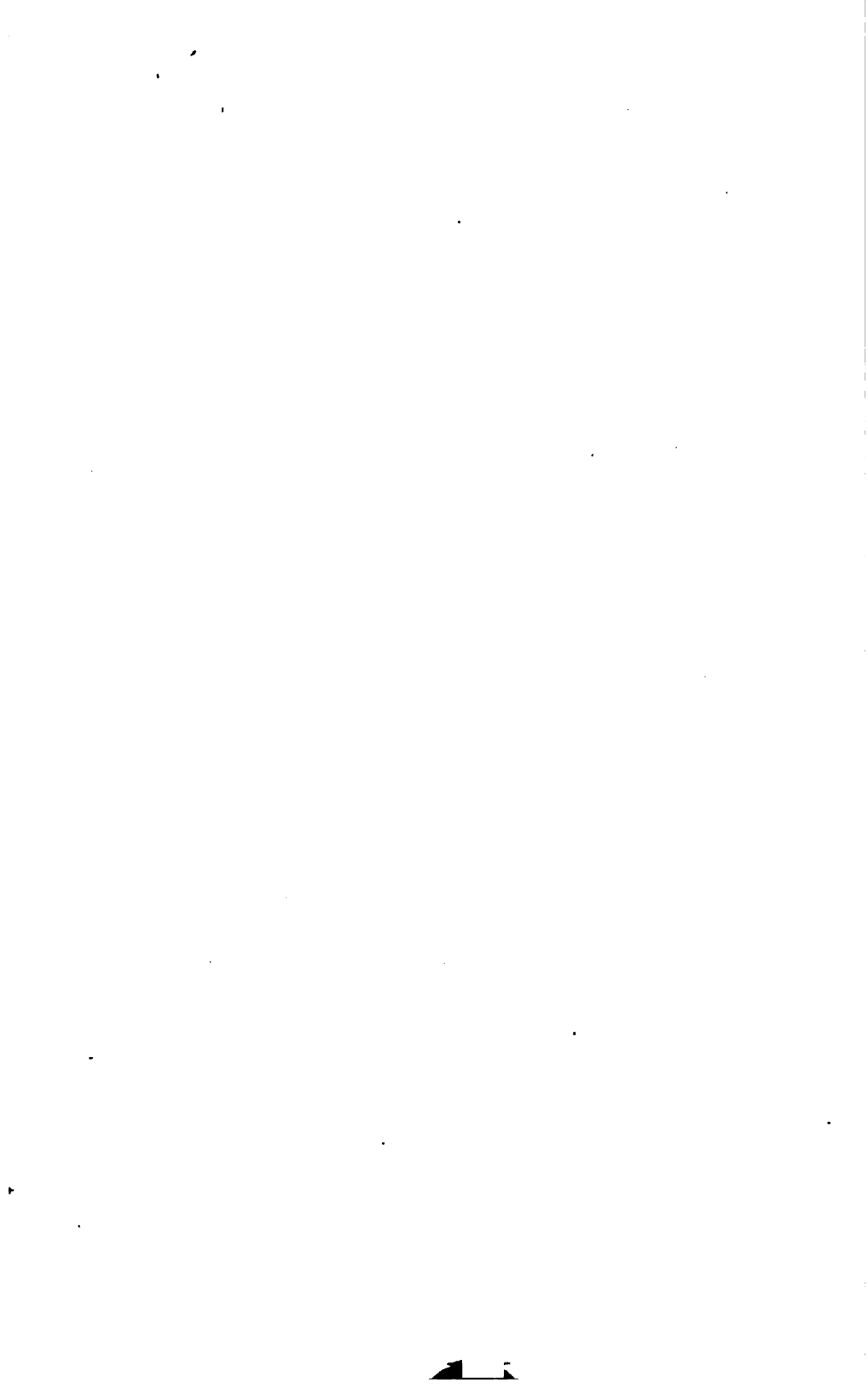
AND

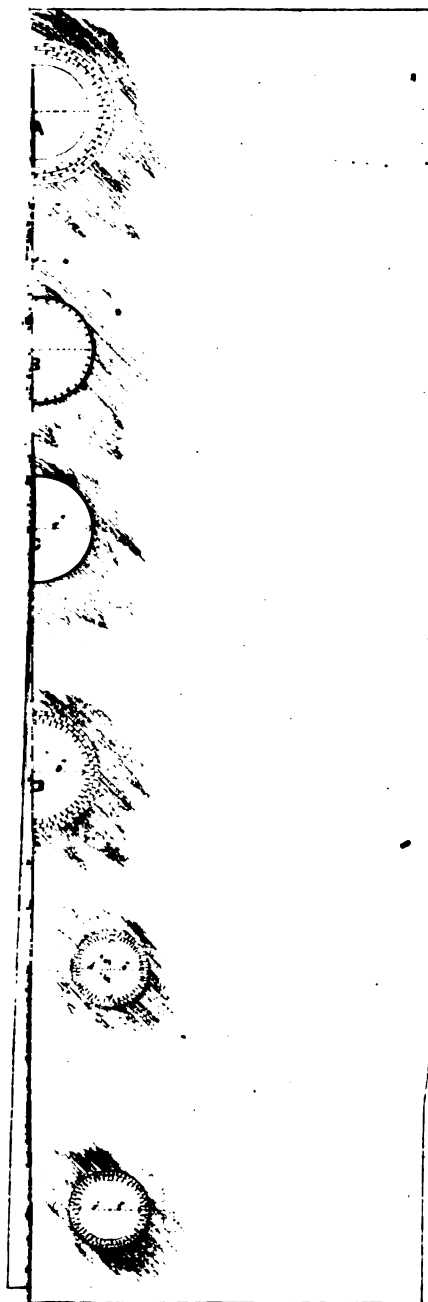
FLOOR PLAN OF CRIB IN

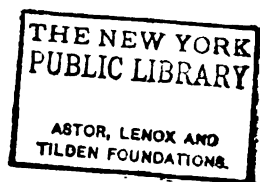


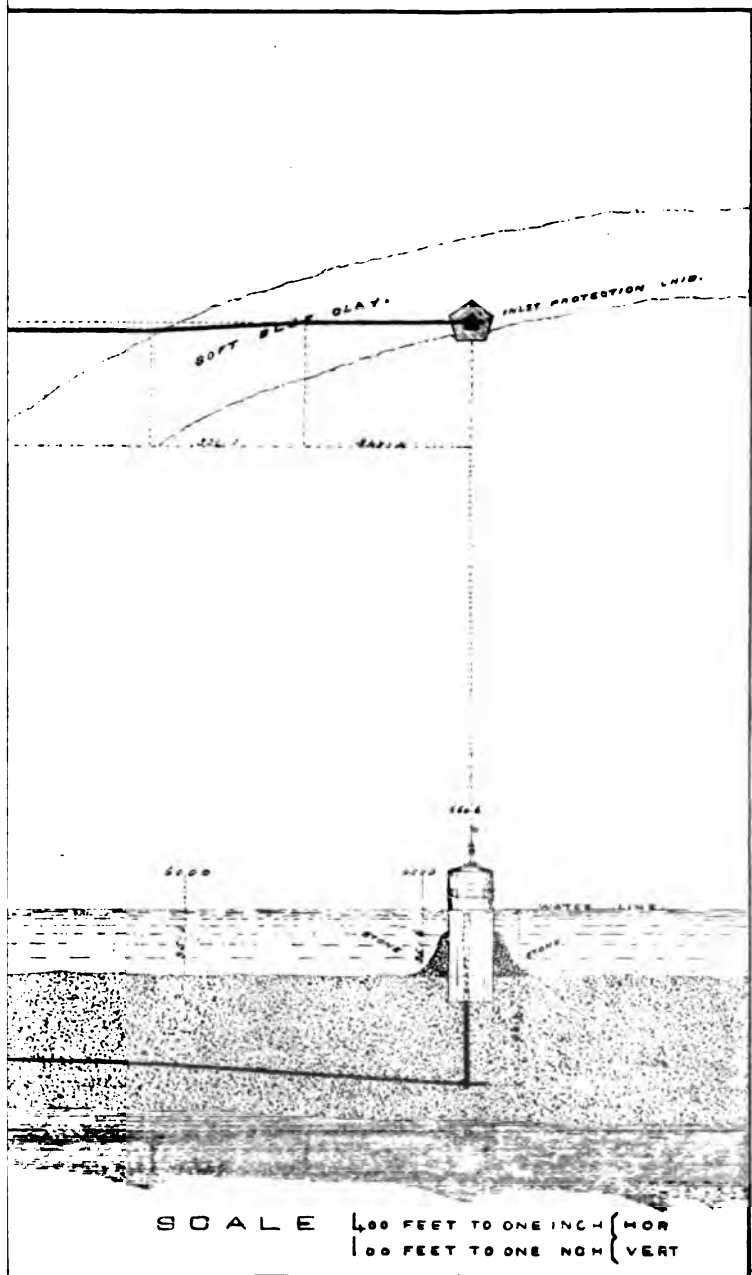
SCALE 16 FEET TO ONE INCH

*Reliotype:*



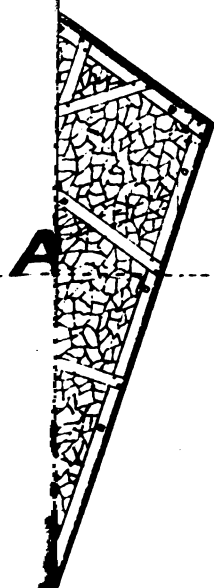






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TILDEN FOUNDATIONS

WILLOW ST



A

UNDER GRID

B

# INLETS

SCALE 10 FEET TO ONE INCH

NEA







**MAP OF WEST PART OF THE CITY OF  
CLEVELAND**

**SHOWING LOCATION OF TUNNEL  
*and*  
CRIB**

**E  
R  
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E**

**SCALE 1000 FEET TO ONE INCH.**





**MAP OF WEST PART OF THE CITY OF**

**CLEVELAND**

**SHOWING LOCATION OF TUNNEL**

*and*

**CRIB**

**E**

**R**

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**SCALE 1600 FEET TO ONE INCH.**



114 E. Price @ 6.

TWENTIETH ANNUAL REPORT

THE NEW YORK  
PUBLIC LIBRARY

OF THE

PICARD

ASTOR, LENOX AND  
TILDEN FOUNDATIONS.

BOARD OF TRUSTEES

OF

# WATER WORKS

TO THE

CITY COUNCIL OF CLEVELAND,

TOGETHER WITH THE

REPORTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1875.

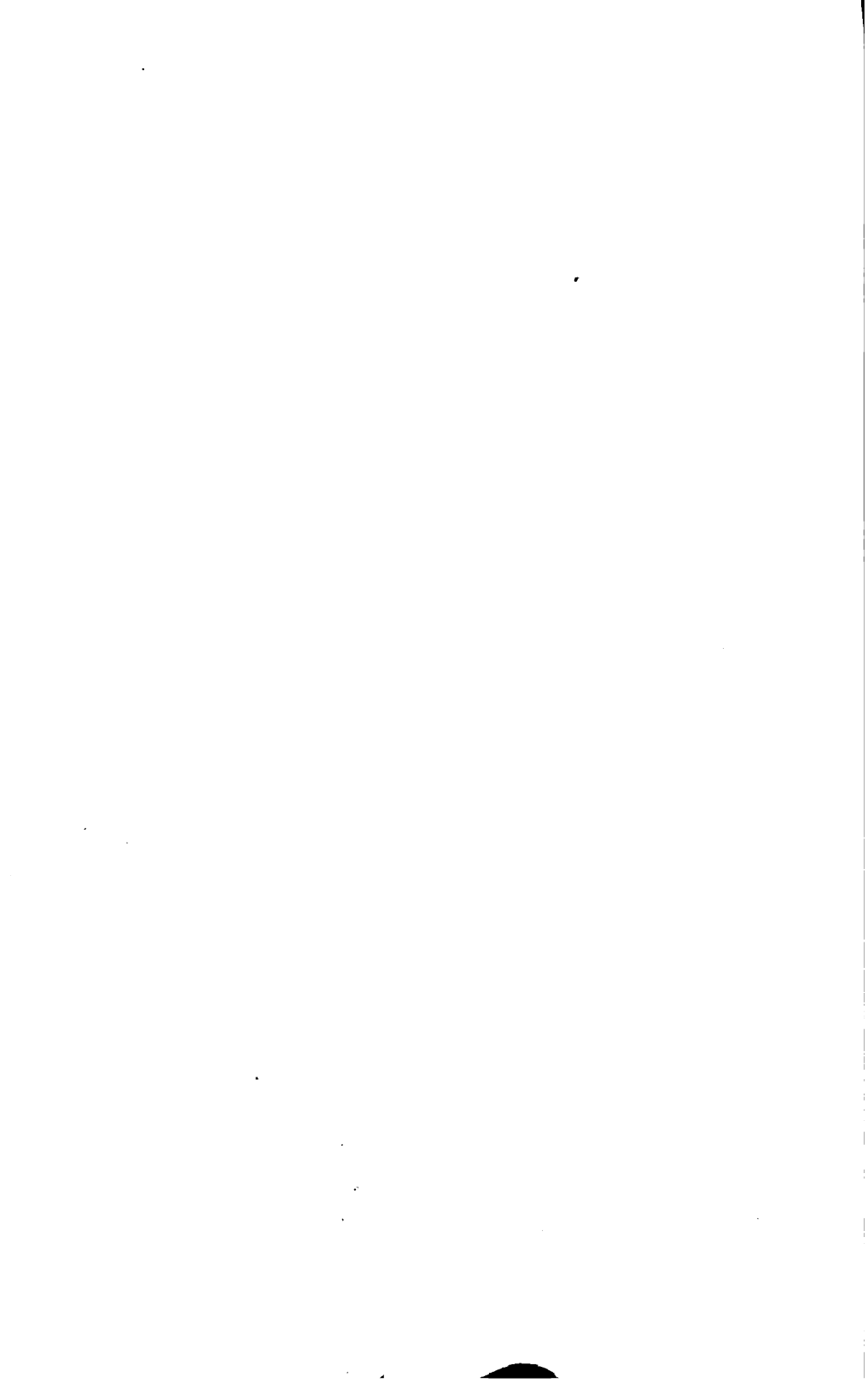
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1876.

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FOR CIVIL ENGINEERS

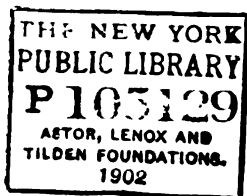


TWENTIETH ANNUAL REPORT  
OF THE  
BOARD OF TRUSTEES  
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TO THE  
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FOR THE YEAR 1875.

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CLEVELAND, O.  
CO-OPERATIVE PRINTING COMPANY, 106 SENECA STREET.  
1876.





# REPORT OF TRUSTEES OF WATER WORKS.

---

*To the Honorable City Council of Cleveland:*

GENTLEMEN:—In presenting this the twentieth annual report of the Trustees of Water Works, we would call your attention to the information and recommendations contained in the report of the Superintendent and Engineer herewith submitted, and especially to that portion of it wherein he directs attention to the necessity of building a permanent superstructure upon the lake crib at an early day. It will be six years in August next since the present structure was placed in position, and although no serious signs of weakness have yet been observed, we know that the timbers above water are decaying, and believe that the improvement recommended should be made without unnecessary delay, and as soon as the plans are matured the Board will call upon you for the funds necessary for doing the work. Your attention is also called to the statement regarding the condition of the boilers for the old pumping works. We would state in this connection that we believe that with the sum authorized to be expended for building the land tunnel and purchasing a new pumping engine we can pay for the work for which the appropriation was made and have a surplus nearly sufficient to pay for these new boilers.

For general information regarding the condition of the works and the improvements made during the year, together with the cost of the same, we refer you to the report of the Superintendent and Engineer and that of the Secretary herewith submitted.

The low price of pipe during the year enabled us, with the liberal appropriation made for that purpose by your honorable body, to lay a large amount of pipe in portions of the city too thinly settled to warrant the Board to make extensions from their own limited funds, while thickly settled and older portions of the city claimed prior recognition of their wants. At the close of the season's work about half of the pipe for which this appropriation was made had been laid, and with that laid and paid for with the funds at our own command amounted to nearly eleven miles.

The still lower price at which we have contracted for pipe for the coming season leads us to believe that the quantity to be laid during this year will considerably exceed that laid last summer.

Regarding the action of the Board in awarding the different contracts for material, work and machinery, they would state that they have been actuated by no other motive than a desire for the public welfare, and if the contracts have not in every instance been awarded to the lowest bidder, they have in all cases been let to the lowest ones having, in their candid judgment, the qualifications recited in the section of the municipal code governing the letting of contracts by Water Works Boards, and when doubts as to the authority conferred upon them by that section presented themselves, they took legal counsel and were governed in making awards by the advice thus received.

In closing, we would respectfully acknowledge the co-operation of your honorable body in granting the funds necessary for carrying out the improvements and extensions recommended by us.

Respectfully submitted,

NELSON PURDY,  
WALTER BLYTHE,  
PATRICK SMITH,

*Trustees of Water Works.*

CLEVELAND, March 17, 1876.

# SECRETARY'S REPORT.

---

*To the Trustees of Water Works :*

GENTLEMEN:—The cash receipts and disbursements by me as Secretary during the year 1875, including balances, are as follows:

## RECEIPTS.

For water, including permits.....	\$114,720 28
Sale of \$50,000 6 per cent. water bonds.....	48,592 90
Bills receivable.....	8,433 56
Interest on same.....	451 28
Running expense account . . . . .	61 63
Repairs account.....	744 10
Pipe extension account.....	702 31
Cash and cash items in office December 31, 1874.....	6,436 68
Total.....	\$180,142 74

## DISBURSEMENTS.

Deposited in the City Treasury.....	\$169,080 26
Water rent refunded.....	118 15
Cash items transferred to bills receivable account.....	4,647 80
Cash and cash items in office December 31, 1875.....	6,296 53
Total.....	\$180,142 74

In consequence of the change in time of payments for water the collections in advance were for two months less time than heretofore, thus reducing the yearly aggregate not less than fifteen thousand dollars.

The amount of the bills and pay rolls certified to the City Auditor for payment is shown in the following ledger accounts:

Running expenses.....	\$ 62,405 40
Repairs.....	12,310 36
Pipe extension.....	95,732 08
Construction.....	2,936 21
Lake crib.....	1,319 86
New engine.....	10,708 96
New engine house ..	19 13
Water meters .....	4,513 60
<b>Total.....</b>	<b>\$189,995 60</b>

The expenditures on the various accounts, after deducting credits, are:

Running expenses.....	\$ 62,343 77
Repairs.....	11,566 26
Pipe extension.....	95,079 77
Construction.....	2,936 21
Lake crib.....	1,319 86
New engines.....	10,708 96
New engine house .....	19 13
Water meters .....	4,513 60
<b>Total.....</b>	<b>\$188,487 56</b>

The monthly account with the City Treasurer is:

DEBTOR.

December 31, 1874, balance in Treasury.....	\$ 41,081 35
February, 1875, to cash.....	79 80
March, to cash.....	436 58
April, to cash.....	1,124 30
May, to cash.....	764 55
June, to cash.....	16,633 51
July, to cash .....	21,175 46
August, to cash.....	4,844 38
September, to cash.....	1,825 25
October, to cash.....	33,116 66
November, to cash.....	29,100 34
December, to cash.....	59,979 43
<b>Total.....</b>	<b>\$210,161 61</b>

# Trustees of Water Works.

7

## CREDITS.

Bills and pay rolls certified to the City Auditor for payment from City Treasury:

January.....	\$ 4,101 99
February.....	4,071 27
March.....	6,879 18
April.....	16,554 36
May.....	16,816 04
June.....	15,396 18
July.....	7,160 46
August.....	13,906 56
September.....	27,401 63
October.....	34,089 50
November.....	25,257 90
December.....	13,846 84
Balance subject to Draft January 1, 1876.....	24,679 61
<b>Total.....</b>	<b>\$210,161 61</b>

## LEDGER BALANCE DECEMBER 31, 1875.

### FACE OF LEDGER.

Construction.....	\$2,120,247 28
City Treasurer.....	24,679 61
Water meters.....	4,513 60
Cash.....	6,296 53
Bonds.....	\$1,575,000 00
Water rents.....	529,080 07
City of Cleveland.....	48,473 60
Interest and Discount.....	3,183 35
	<hr/>
	\$2,155,737 02    \$2,155,737 02

## BONDED DEBT.

The bonded debt of the city for Water Works purposes has been increased during the year by the issue of fifty thousand dollars of six per cent. bonds. The present bonded debt is:

Six per cent. bonds due July 1, 1878..	\$ 25,000 00
Six per cent. bonds due July 1, 1879 .....	25,000 00
Seven per cent. bonds due January 1, 1879.....	400,000 00
Seven per cent. bonds due October 1, 1880.....	75,000 00
Seven per cent. bonds due January 1, 1881.....	100,000 00

Seven per cent. bonds due January 1, 1884.....	300,000 00
Seven per cent. bonds due May 1, 1892.....	400,000 00
Seven per cent. bonds due May 1, 1893.....	200,000 00
Six per cent. bonds due October 1, 1895.....	50,000 00
	<hr/>
	\$1,575,000 00

The sinking fund of the city is pledged for the payment of the principal of nine hundred and twenty-five thousand dollars of the bonds, being the first six amounts specified, which fund is without doubt sufficient for that purpose. The interest is paid by a general tax levied on all the taxable property in the city.

Respectfully submitted,

H. C. HAWKINS,

*Secretary.*

## REPORT OF SUPERINTENDENT AND ENGINEER.

---

*To the Board of Trustees of Water Works:*

GENTLEMEN:—The twentieth annual report of the Superintendent and Engineer of Water Works is herewith respectfully submitted:

### LAKE CRIB.

The lake crib protecting the inlet shaft of the tunnel has been in position nearly six years, and as a natural consequence is beginning to show unmistakable signs of decay from the water line up to the floor timbers. It will, therefore, be necessary, at an early day, to prepare plans for a permanent superstructure to take the place of the temporary building now used. From the water line down to a depth of five feet the outer pockets were filled with concrete, as a foundation for a permanent structure whenever such a building became necessary. The expense and delay in preparing a foundation will therefore be unnecessary.

During last winter two of the boiler iron plates fastened to the crib at the water line to shield the timbers from the cutting action of floating ice were torn off, and new plates have been put on in their place.

The stone thrown around the outside of the crib to protect it from the action of storms, and to act as a brace to prevent it from rocking, having been leveled down by the undertow of the waves, it was thought prudent to add more and heavier stone, and in accordance with your orders, about two hundred cords



have been thrown into the lake against the sides of the crib. Two-thirds of these have a bulk of nine cubic feet and upward. When the work was completed the depth of water against the crib averaged about twelve feet; since the fall storms the depth has been increased and is now from twelve to eighteen feet.

### LAKE TUNNEL.

There has been no interruption to the supply of water through the tunnel since its opening, and the quality of the water has been fully up to the standard claimed for it when the work was projected. During the very cold weather of last winter, when the lake was covered with an unbroken sheet of ice for nearly three months, the water had an insipid taste, as the natural result of a want of aeration. With this exception, and the slight discoloration caused by clay washed from the bottom of the lake during heavy storms, the water has been good, and up to this time the water discharged from the river has never reached the crib.

### THE AQUEDUCT.

Owing to the high stage of water in the lake, the old aqueduct has supplied the pumps with an abundance of water for the past year. No repairs have been required on the aqueduct, and the work of cleaning it out has been rendered unnecessary by reason of the high stage of water.

### NEW LAND TUNNEL.

This new tunnel is to extend from the shore end of the lake tunnel to the pumping works, and is to take the place of the present aqueduct. It will be 2,580 feet long, and in form will be oval, the diameter being  $5\frac{1}{2}$  and 6 feet. The bottom will be ten inches lower than that of the lake tunnel at the shore end, and about 74 feet below the surface of Old River street. There will be two shafts, one at the pumping works and the other just west of the intersection of Weddell and Old River streets. Work will be carried on from both of these shafts at the same

time, so as to expedite its completion. No time should be lost in carrying out the work, as the demand for water will soon be greater than the supply that can be drawn through the old aqueduct.

### BUILDINGS AND GROUNDS.

The repairs and improvements recommended by the engineer of pumping works in his last annual report have all been completed. There has also been a large amount of work done in filling up the lot and taking up the springs in different parts of the grounds. For the latter purpose a drain or sewer has been built from the south side of the new building to the river bed, with catch basins located at such points as the engineer believed were necessary. A branch sewer extends from the main to the southwest corner of the lot, and takes in the water from the large spring that was the cause of so much annoyance last winter. I would recommend that the grounds be enclosed by a new fence during the coming summer, and that the portion in front of the buildings be graded and turfed or seeded and laid out so as to present a more attractive appearance; also that the metal roofs of both buildings, including stand pipe tower, be painted.

### ENGINES AND BOILERS.

The increasing demand for lake water has made it necessary to procure additional pumping machinery to be placed in the new engine house. The Cornish engines, no longer capable of pumping all the water required, are for the present only used as auxiliaries to the Cuyahoga Duplex engines during the summer and mid-winter months. There is therefore no adequate reserve power to rely upon in case of accident to the Duplex engines, and as the latter have not been overhauled or repacked for nearly a year, it is deemed prudent to run them with more care than would be necessary if there was the usual amount of power in reserve to rely upon in case of breakage. They have consequently been worked at a speed much slower than they are capable of making for the last half of the year, and during the fall and early winter months have pumped nearly all the water supplied,

being assisted only at intervals by the Cornish engines. These latter engines are in good working order. The lower valve chambers of both of them, and the stop valve chamber of the east engine, are in the same condition as at the date of the last annual report. The fractures have not caused any trouble during the year. I would recommend that these fractured chambers be renewed as early as possible. The new stop valve for the east engine has been on hand ready to set for more than two years, as has also a new lower valve chamber for the west engine; these, at least, should be put in place as soon as an opportunity offers. The boilers for the Cornish engines have been in use for over twenty years, and are beginning to show signs of weakness; the iron in portions of them is now less than half its original thickness. I would therefore call your attention to their condition and recommend that new ones be built for these engines without unnecessary delay. The Cornish boilers built for the Duplex engines are not giving the satisfaction in regard to durability and economy in fuel that might be expected to result from the use of that well known style of boiler. The quantity of water evaporated per pound of coal consumed indicates a lack of heating surface and grate surface that makes it necessary to crowd the fires to a degree that must in time prove destructive to the boilers; and paradoxical as such a statement may appear to be, the great strength and rigidity of the flues will tend to hasten their destruction.

#### MAIN PIPES.

During the early part of the year the new engines pumped directly into the supply mains, and such water as found its way into the reservoir did so after making a circuit of the city through the outlet pipes; the result was an extreme variation in the pressure of water in the pipes, amounting in some localities to sixteen pounds to the square inch between the strokes of the pumps. The connection valve between the old and new pumping mains has since been opened, allowing the surplus water to pass freely into the reservoir, thus making the pressure uniform.

With such a varying pressure on the mains it would naturally be supposed that the number of leaks would be greatly increased, but such was not the case, the number being no greater than usual.

### RESERVOIRS AND GROUNDS.

The quality of the water now supplied is so much better than before the completion of the tunnel that the deposit of sediment on the slopes is scarcely perceptible, and it is not probable that the reservoir will require cleaning again for a number of years. The grass on the south part of the lot having nearly all died out, it is proposed to plow the ground and cultivate some kind of hoed crop for one season, to kill the weeds, after which it will again be seeded to grass. I would recommend that the fences be painted, and the bridges to the valve rods be either repaired or rebuilt. The walks, stairs and shrubbery are in good order.

### DISTRIBUTION.

There have been laid during the year ten miles and 4,140 feet of the different sizes of pipe, making the total quantity now in use of all sizes 91 miles and 3,521 feet. Eight-inch pipes have been laid in Superior street, between Water and Erie streets, in Seneca street, between Superior and Michigan streets, and in Champlain street, between Seneca and Ontario streets. These lines have been laid for the better protection of the property abutting upon them against fire. Thirteen new six-inch fire hydrants have been connected with these pipes in addition to the old ones, thus affording an abundant supply of water for all the steamers belonging to the Fire Department, at one time, in any part of the district embraced within the reach of these pipes. Six-inch connections have also been made with all the fire cisterns in the lower portion of the city, where the supply pipe in the street was of that size or larger. These improvements have long been demanded, but the funds at the disposal of the Water Department have never been sufficient to enable the Trustees to satisfy the demand for pipe in streets where no pipe had previously been laid. It was therefore deemed advisable to ask the

City Council to furnish funds with which to lay not only the pipes named, but others of nearly equal importance, for protection against fire. In response to the application of your Board, the special committee of the Council, to whom the application was referred, reported in favor of issuing bonds to the amount of \$115,000 for laying pipes in a number of streets agreed upon by the committee and the Water Works Department, which report was adopted by the Council and the bonds were issued. A large portion of the pipe has been laid during the past fall, and the remainder will be laid early in the coming season. It will be seen by the attached list of pipes that the proportion of large pipe laid is greater than during any previous year.

#### FROST.

The depth to which frost penetrated the ground last winter was greater than has ever been known since the water works were built. In many instances connections to fire hydrants and cisterns, and ends of pipes having no circulation, were found frozen at a depth of five feet, and the number of service pipes closed by frost was unusually large. It is impossible, however, to state the number, as only a small portion of them were reported to the officers of the Department. A large number of hydrants were found frozen during the very cold weather. The practice of opening them at such a time when the metal is filled with frost and the water in the pipes is scarcely above freezing point, is very unwise, and was no doubt the cause of the freezing of a great many of them. It will be apparent to any one giving this subject a moment's thought that water at such a low temperature, coming in contact with metal filled with frost, will immediately form ice, and when the hydrant is closed, after trying it, the waste hole at the bottom through which the water remaining in the hydrant should waste, becomes clogged with ice and prevents the escape of the water. The next time the hydrant is examined, if in cold weather, it will, as a matter of course, be found frozen.

All the hydrants used for fire protection should be examined each year before cold weather sets in, and such as need repairs or cleaning out should be put in good order, after which they

should not be opened in cold weather, excepting in case of fire. All pipe laid the past year was placed six feet below the grade line of the streets, and such lines of old pipe as were found frozen last winter were lowered to the same depth. The number of pipes broken last winter by frost was 57, and of branch pieces 6. The length of street deprived of water by reason of frozen pipes was 2,800 feet.

### METERS.

The number of meters in use on the 31st day of December last was 111. The different sizes and number of each size is as follows:

$\frac{1}{4}$ inch.....	13
1 inch.....	42
$1\frac{1}{4}$ inch.....	24
2 inch.....	22
3 inch.....	7
4 inch.....	3

In addition to these are 15 hydraulic elevators, to each of which is attached a register that records the quantity of water used.

### SERVICE CONNECTIONS.

The number of new service connections made with the distributing pipes during the year is as follows:

4 inch.....	9
3 inch ..	2
2 inch.....	3
$1\frac{1}{2}$ inch.....	4
1 inch.....	4
$\frac{3}{4}$ inch.....	15
$\frac{1}{2}$ inch.....	885

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Total in 1875..... 922

The whole number of service connections and their different sizes is as follows:

6 inch.....	1
4 inch.....	22
3 inch.....	25

2 inch.....	48
1½ inch.....	16
1 inch.....	103
¾ inch... ..	295
½ inch.....	7,501

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Total of all sizes to January, 1876..... 8,011

Of this number 1,662 are not in use, the greater portion of them having been laid only to the curb line in streets recently paved.

### OFFICE WORK.

A new map of the city has been made on a scale of 400 feet to the inch, on which is shown the pipe system, tunnel, reservoir and buildings of the Water Works. A large number of street maps have also been made, on a scale of 100 feet to 1 inch, showing the location of service pipes, etc. These will be bound in book form, and when finished will be a complete record of the pipe system of the city. A book of record, simple and convenient in form, has also been made, in which is given the location of every service stop cock in the city.

### METER RATES.

Complaints have been made by some of our manufacturers and large water consumers that the rates charged for water measured by meters are excessive, and higher than are collected by other cities. So far as we have been able to learn from official reports, there is but one other city in this country, where the water is pumped by steam power, in which the uniform meter rates appear to be lower than in Cleveland. Chicago furnishes water through meters at a uniform charge of 10 cents for 1,000 gallons, the extreme height to which it is pumped being 133 feet. The elevation to which the water is pumped in Cleveland is 164 feet, and taking the price charged in Chicago as a basis for a rate in Cleveland, it should be 12½ cents per 1,000 gallons as a uniform price. The rates in Cleveland, commuted from the published table, are as follows:

When 50,000 cubic feet is used in six months, 16 cents per 1,000 gallons.

"	100,000	"	"	"	"	14 7-10	"	"
"	200,000	"	"	"	"	13 3-10	"	"
"	300,000	"	"	"	"	12 4-10	"	"
"	400,000	"	"	"	"	11 7-10	"	"
"	500,000	"	"	"	"	11 2-10	"	"
"	600,000	"	"	"	"	10 9-10	"	"
"	700,000	"	"	"	"	10 7-10	"	"
"	800,000	"	"	"	"	10 52-100	"	"
"	900,000	"	"	"	"	10 4-10	"	"
"	1,000,000	"	"	"	"	10 29-100	"	"

It will be seen that the water rates in Cleveland are, if due allowance is made for the difference in elevation to which the water is pumped, lower than in Chicago when the quantity used exceeds 300,000 feet in six months. And it is from consumers using the largest quantities that the loudest complaints are received.

As in all other northern cities having Water Works, the expenditures for repairs on account of the severe frosts of last winter have been unusually large. The expense of lowering pipe and repairing such as were broken by frost has been charged to that account.

The opportunity afforded to make general repairs on the old engines was also taken advantage of, and a considerable sum was expended upon them, as well as upon the buildings.

The expenditures for the year have been as follows:

RUNNING EXPENSES.

Labor pay rolls.....	\$17,874 47
Office rent.....	1,100 00
Plumbing.....	467 50
Meter boxes and carpenter work.....	134 17
Pipe fittings and globe valves.....	120 75
Brass work and ferrules....	422 50
Heliotype drawings for reports.....	252 00
Printing and stationery.....	281 17
Advertising.....	89 50
Brass pump.....	10 00
Cartage and freight.....	85 71
Gas bills for office....	10 84



Manure for reservoir grass.....	52 50
Making surveys, etc., for new reservoir....	271 50
Sundries, traveling expenses, recording, broom, car fare.....	203 89
	<hr/>
	\$21,376 50
Credit .....	61 63
	<hr/>
Total.....	\$21,314 87

## ENGINE HOUSE EXPENSES.

Labor pay rolls.....	\$14,845 06
Oil and tallow.....	1,269 92
Coal.....	18,598 56
Gas bills.....	527 84
Hardware, shovels, etc.....	161 68
Blacksmithing and iron work.....	72 93
Cotton waste .....	60 15
Boiler compound.....	25 00
Soap compound.....	18 40
Red lead and oil.....	17 48
Brooms.....	29 90
Cement, fire clay, brick and mason work.....	25 16
Carpenter work.....	48 99
Rubber gaskets.....	3 09
	<hr/>
Total.....	\$35,704 16

## RUNNING EXPENSES—CRIB.

Labor pay rolls.....	\$ 720 00
Oil.....	89 55
Sundries.....	1 59
	<hr/>
Total.....	\$ 811 14

## RECAPITULATION.

Office, reservoir, and general expenses.....	\$21,314 87
Engine house.....	35,704 16
Crib.....	811 14
	<hr/>
Total.....	\$57,830 17

## WATER METER ACCOUNT.

Water meters.....	\$4,513 60
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## CONSTRUCTION.

Labor pay rolls.....	\$1,854 82
Use of engine and pump.....	240 00
Sewer pipe and cement.....	285 60
Brick.....	224 00
Lake sand, gravel and clay.....	90 75
Stone.....	64 30
Lumber.....	24 80
Castings, manhole covers.....	16 74
Cartage.....	89 00
Printing, stationery and advertising....	46 20
Total.....	\$2,936 21

## NEW ENGINES.

Cuyahoga Steam Furnace Co., final estimate.....	\$10,669 74
Fittings.....	26 72
Advertising.....	12 50
Total.....	\$10,708 96

## NEW ENGINE HOUSE.

Paid for sewer pipe.....	\$19 13
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## CRIB.

Stone around crib.....	\$1,309 86
Advertising for stone.....	10 00
Total.....	\$1,319 86

## PIPE EXTENSION.

Labor pay rolls.....	\$15,833 79
Cast iron pipe and castings delivered.....	55,598 57
Valves.....	7,029 00
Fire hydrants.....	7,049 00
Pig lead.....	5,237 79
Puddling and paving.....	2,194 19

Cartage.....	683 40
Blacksmithing and iron work..	335 56
Hemp packing.....	226 00
Paid for damages.....	247 50
Plumbing and fitting.....	159 07
Freight.....	143 79
Coal...	98 25
Scales.....	85 00
Hardware.....	50 24
Wooden plugs.....	61 45
Ladles and lead furnaces.....	41 07
Lumber and sprinkling boxes.....	35 33
Mason work.....	24 00
Fire clay.....	18 00
Advertising.....	20 00
Sundries, oil, car fare, etc., etc.....	11 06
	<hr/>
	\$95,782 08
Credit.....	702 31
Total.....	\$95,079 77

## REPAIRS.

Labor pay rolls.....	\$ 7,260 58
Castings.....	316 94
Blacksmithing and machine work.....	938 07
Valves.....	367 00
Plumbing.....	144 13
Coal.....	194 60
Cartage.....	566 77
Twine and cloth.....	47 32
Lamps, etc.....	35 70
Rubber gaskets.....	13 60
Pipe and fittings.....	17 64
Blocks and tackle.....	19 96
Repairs on meters.....	23 83
White lead.....	15 13
Wooden plugs.....	13 05
Globe valves.....	7 50
Repairs on globe valves.....	2 50
Pig lead.....	4 95
Sundries, oil, etc.....	18 77
Repairs on crib and boat.....	308 07
Carpenter work and lumber for reservoir.....	61 56

*Trustees of Water Works.*

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ENGINE HOUSE.

Repairs on Cornish engines and boilers.....	\$1,457 40	
Lead and oil.....	22 88	
Cement and sand .....	70 95	
Lime.....	19 95	
Brick .....	96 00	
Fire brick and clay. ....	31 40	
Carpenter work and lumber, .....	234 11	
		<hr/>
		\$ 1,932 69
		<hr/>
		\$12,300 36
Credit .....		744 10
		<hr/>
Total.....		\$11,556 26

**SCHEDULE.**  
**ENGINE RECORD FOR 1875.**  
**COMPOUND DUPLEX ENGINES.**

Months.	Days.	Pumping.			Coal Consumed.		Gallons of Water Pumped.	Height in Feet.
		H	M	Strokes	Pumping.	Total.		
January.....	29	450	10	361,806	955,500	955,500	196,135.081	159.4
February.....	28	619	55	454,081	1,128,000	1,128,000	246,130,206	159.28
March.....	31	736	31	480,171	1,102,400	1,102,400	260,300,700	158.93
April.....	30	719	10	432,592	853,800	853,800	234,508,123	158.87
May.....	31	743	40	442,954	951,800	951,800	240,125,363	158
June.....	30	719	5	436,908	970,400	970,400	236,847,726	158.07
July.....	31	739	...	462,738	970,200	970,200	230,882,795	158.07
August.....	31	741	...	419,991	892,000	892,000	227,677,121	157.87
September.....	30	703	55	438,115	861,400	861,400	237,502,142	157.96
October.....	31	708	50	420,020	886,700	886,700	227,692,842	158.09
November.....	30	721	30	385,870	880,500	880,500	209,186,127	158.1
December.....	30	691	40	375,190	906,400	906,400	201,390,499	158.3
Totals and Av'ges	362	8294	26	5,110,446	11,449,100	11,449,100	2,770,372,675	158.41

**SCHEDULE.**  
**ENGINE RECORD FOR 1875.**

**EAST ENGINE.**

Months.	Pumping.			Coal Consumed.			Gallons of Water Pumped.	Height in feet.
	H.	M.	Strokes	Raising Steam.	Pumping	Total.		
January.....	2	15	35	6,875	9,400	9,400	2,308,250	158.62
February.....	2	15	35	6,875	9,400	9,400	2,308,250	158.62
March.....	2	15	35	6,875	9,400	9,400	2,308,250	158.62
April.....	2	15	35	6,875	9,400	9,400	2,308,250	158.62
May.....	2	15	35	6,875	9,400	9,400	2,308,250	158.62
June.....	3	22	55	10,800	6,600	12,200	3,408,960	158.36
July.....	16	130	55	64,350	22,200	70,610	20,669,320	158.07
August.....	7	46	10	22,750	10,800	24,200	7,307,300	158.55
September.....	8	58	13	30,400	12,200	45,400	9,764,480	158.10
October.....	10	1	10	6,875	9,400	9,400	2,308,250	158.62
November.....	2	15	35	6,875	9,400	9,400	2,308,250	158.62
December.....	2	45	25	19,875	2,200	22,585	6,379,875	157.62
Totals and Averages.....	78	318	30	155,050	65,000	170,385	49,798,085	158.22

**WEST ENGINE.**

January.....	2	43	30	22,750	24,600	24,600	7,307,300	158.62
February.....	2	43	30	22,750	24,600	24,600	7,307,300	158.62
March.....	2	43	30	22,750	24,600	24,600	7,307,300	158.62
April.....	2	43	30	22,750	24,600	24,600	7,307,300	158.62
May.....	2	43	30	22,750	24,600	24,600	7,307,300	158.62
June.....	10	73	30	33,575	23,300	37,700	10,784,240	158.09
July.....	6	49	35	25,380	12,000	34,600	7,512,868	158.09
August.....	10	60	45	28,350	20,400	30,500	9,106,920	157.99
September.....	1	12	30	6,900	5,800	6,800	2,023,560	157.33
October.....	1	9	30	4,625	7,600	4,800	1,486,550	157.75
November.....	2	43	30	22,750	24,600	24,600	7,307,300	158.62
December.....	9	83	37	47,375	19,400	49,200	15,307,375	158.70
Totals and Averages.....	89	332	47	166,365	88,500	169,200	53,427,963	158.08

**BOTH ENGINES.**

Totals and Averages.....	77	651	7	321,415	143,500	339,585	483,085	108,226,048	158.15
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**TOTALS AND AVERAGES FOR BOTH CORNISH ENGINES FOR EACH YEAR  
SINCE THE CONSTRUCTION OF THE WORKS.**

Years.	Pumping.			Coal Consumed.			Gallons of Water Pumped.	Height in feet.	Duty.
	H	M	Strokes	Raising Steam.	Pump'g	Total.			
1857.....	1,206	25	399,894	236,200	407,325	633,525	127,262,265	158	
1858.....	1,454	55	446,724	232,050	430,225	662,275	142,157,434	156.533	31,453,325
1859.....	1,413	00	623,775	233,050	549,640	782,650	198,334,090	155.927	35,607,222
1860.....	1,811	05	818,303	298,750	707,950	766,700	260,220,354	156.466	35,206,903
1861.....	2,107	35	1,013,129	365,600	854,150	1,118,750	324,175,022	156.457	37,548,089
1862.....	2,347	35	1,162,494	376,816	1,115,127	1,391,978	369,673,082	156.357	34,729,024
1863.....	2,590	30	1,310,875	281,903	1,169,418	1,551,311	420,790,875	156.693	35,535,428
1864.....	2,848	10	1,482,225	374,744	1,445,568	1,729,362	476,114,225	157.313	36,410,146
1865.....	2,971	40	1,611,405	286,950	1,579,550	1,866,500	517,361,005	158.017	36,621,770
1866.....	3,321	35	1,829,820	276,800	1,925,400	2,302,200	587,372,320	159.731	35,304,587
1867.....	3,870	10	2,169,375	200,200	2,162,400	2,432,600	696,369,375	157.439	37,685,426
1868.....	4,503	13	2,394,975	198,100	2,078,900	2,078,900	768,786,975	157.822	44,264,421
1869.....	5,073	00	2,894,425	70,000	2,585,000	2,655,000	888,036,425	157.509	44,597,444
1870.....	6,852	20	3,568,500	49,000	3,388,200	3,437,200	1,126,228,500	156.970	45,010,520
1871.....	8,648	35	4,296,500	63,200	4,334,400	4,395,600	1,367,621,100	157.781	41,108,940
1872.....	10,562	57	5,251,495	45,200	5,430,800	5,476,000	1,686,370,595	158.377	40,788,146
1873.....	12,868	50	5,824,825	13,600	6,122,300	6,135,900	1,869,768,835	157.886	40,631,983
1874.....	11,089	05	5,163,325	37,400	5,379,400	5,416,500	1,658,460,090	157.400	40,080,999
1875.....	661	07	321,415	143,500	339,655	483,080	103,226,048	158.180	47,775,460

**SCHEDULE,**

Showing the distribution of water for each month in the year 1875.

MONTHS.	Gallons of Water pumped by Cornish En.	Gallons of Water pumped by Duplex Engines.	GALLONS DISTRIBUTED.			
			Per Month.	Average per day.	Each inhabit't per day.	Each consen'r per day.
January.....	9,515,560	196,135,031	205,650,581	6,633,869	48.07	104.4
February.....		246,130,206	246,130,206	8,790,364	63.69	138.4
March.....		260,300,700	260,300,700	8,896,796	60.84	132.2
April.....		234,508,123	234,508,123	7,816,937	56.64	123.1
May.....		240,126,363	240,126,363	7,745,979	56.13	122.0
June.....	14,253,250	226,847,726	251,100,976	8,370,032	60.65	131.6
July.....	23,182,088	250,882,795	279,064,883	9,002,093	65.23	141.7
August.....	16,413,320	227,677,121	244,090,441	7,873,885	57.05	124.1
September.....	11,783,040	237,502,142	249,290,182	8,309,672	60.21	130.8
October.....	1,486,560	227,692,842	229,179,392	7,392,883	53.57	116.4
November.....		209,180,127	209,180,127	6,972,670	50.52	109.8
December.....	21,587,250	203,390,499	224,977,749	7,257,346	52.58	114.3
Total and Averages.	103,226,048	2,770,372,675	2,873,598,723	7,800,212	57.09	124.0

**TOTALS AND AVERAGES FOR EACH YEAR SINCE THE COMPLETION OF  
THE OLD WORKS.**

Years.	GALLONS DISTRIBUTED.				Per cent. of increase
	Per Year.	Per Day.	E'ch inh't per day.	Each cons'r per day.	
1857.....	127,362,265	348,684	7.75	110.68	
1858.....	142,155,434	392,467	8.37	18.44	11.70
1859.....	198,324,090	513,107	11.31	91.27	89.45
1860.....	260,320,354	710,984	14.11	101.57	31.87
1861.....	321,175,082	881,599	18.32	114.50	25.81
1862.....	369,673,092	1,012,794	19.47	120.57	14.74
1863.....	420,790,875	1,152,875	20.97	117.54	12.83
1864.....	475,114,225	1,300,858	21.68	123.89	12.14
1865.....	517,361,005	1,417,153	21.80	122.70	8.64
1866.....	587,972,220	1,609,239	22.35	124.26	13.56
1867.....	696,369,575	1,907,851	23.85	115.98	18.55
1868.....	768,786,975	2,108,265	24.77	116.08	10.40
1869.....	898,696,425	2,462,839	27.36	120.20	16.92
1870.....	1,126,328,500	3,085,558	30.86	113.30	25.23
1871.....	1,367,621,100	3,746,907	35.68	124.90	21.43
1872.....	1,686,570,895	4,607,571	40.07	131.64	22.67
1873.....	1,899,768,835	5,095,230	43.08	137.71	10.85
1874.....	2,050,252,910	5,625,150	45.36	141.1	9.65
1875.....	2,575,698,723	7,080,212	57.09	124.0	40.1



## SCHEDULE

Showing the extension of water pipe in 1875:

Diameter in inches.	Street.	Between what Points.	Feet of pipe laid.	Total.	Remarks.
12	Willson avenue.	Cross in Euclid to 24 ft. s. East Pros.	1,054		
				1,054	
10	Clark avenue.	Cross in Burton to Pleasant.	2,153		
10	Clark avenue.	T in Hitchcock to east line Hitchcock.	36		
10	Clark avenue.	Cross in Columbus to w. line Colm's.	31		
10	Columbus.	Cross in Walton to s. line of Clark.	476		
10	Detroit.	T in Scott to T in Oakland.	189		
10	Euclid avenue.	Cross in Willson to 70 ft. east Tilden.	6,425		
10	Lincoln avenue.	T in Euclid to south line Euclid.	45		
10	Oakland.	T in Detroit to north line Detroit.	40		
10	Scott.	T in Detroit to south line Detroit.	18		
10	Superior.	Cross in Willson to west line.	42		
10	Willson.	Cross in Euclid to cross in Superior.	4,967		
				14,422	
8	Champlain.	Cross in Seneca to cross in Ontario.	567		Relaid.
8	Custead.	T in Euclid north.	51		
8	Detroit.	Cross in Kentucky to T in Scott.	3,136		
8	Detroit.	T in Oakland west.	273		
8	East Prospect.	T in Willson to east line.	56		
8	Prospect.	T in Willson west.	34		
8	Superior.	Cross in Willson to east line.	58		
8	Superior.	T in Erie to Public Square.	1,379		
8	Superior.	T in Water to Public Square.	1,408		
8	Seneca.	Between 8 and 20 in. mains in Sup'r.	34		
8	Seneca.	Cross in Superior to north line.	37		
8	Seneca.	Cross in Superior to cross in Michigan.	765		Relaid.
8	Water.	From 20 inch main in Superior north.	24		
8	Willson avenue.	Cross in Superior to n. line St. Clair.	1,542		
8	Willson avenue.	From 147 ft n. B. st. to s. line Julia.	1,281		
				10,645	
6	Alabama.	T in Superior to Payne ave.	971		
6	Arlington.	Garden to Cedar.	1,417		
6	Burnham.	T in Scovill to Woodland.	939		
6	Barber avenue.	Columbus st. east.	10		
6	Birch.	T in Detroit to north line.	25		
6	Bond.	T in Superior north.	30		
6	Burton.	Buckley to T in Clark avenue.	1,769		
6	Champlain.	Cross in Seneca west.	40		Relaid.
6	Carrol.	T in Fulton east.	52		
6	Cedar.	Cross in Kennard west.	638		
6	Chatham.	Pearl street west.	25		
6	Courtland.	North line Franklin to T in Detroit.	751		
6	Clark avenue.	T in Columbus street east.	40		
6	Clark avenue.	W. line Scranton to cross in Jennings.	1,594		
6	Detroit.	From 8 inch cross in Kentucky east.	26		
6	Delaware.	North line Payne avenue south.	16		
6	Dibble.	T in Willson avenue east.	70		
6	Dare.	T in Detroit south.	32		
6	Dunham.	T in Euclid to 18 feet n. of Hough ave.	1,944		
6	Erie.	T in Columbus west.	28		
6	Franklin.	Pearl st. 260 feet e. of angle at Russia.	510		
6	Giddings avenue.	Across at Euclid.	96		
6	Highland.	T in Euclid north.	36		
6	Harmon.	T in Scovill to north line Woodland.	913		
6	Harbor.	C. in Bridge to con. pipe near Randall.	1,164		
6	Hanover.	Cross in Clinton to Circle.	338		
6	Jennings avenue.	Cross in Clark avenue north.	178		
6	Jersey.	Cross in Fulton south.	50		
6	Kentucky.	Across Detroit.	66		
6	Kennard.	South line Prospect to cross in Sibley.	404		
6	Kennard.	Cross in Cedar south.	300		
6	Lawrence.	Cross in Superior to s. line St. Clair.	907		
6	Liberty.	T in Detroit street south.	28		

## SCHEDULE

Showing the extension of water pipe in 1875.—Continued.

Diameter in inches.	Street.	Between what Points.	Feet of pipe laid.	Total.	Remarks.
6	Lena avenue. ....	Cross in Willson avenue east.....	70		
6	Luther. ....	Cross in Willson avenue east.....	70		
6	Long. ....	T in Seneca street, west.....	20		
6	Irring. ....	T in Broadway, north.....	447		
6	Michigan. ....	Cross in Seneca to east line Seneca st.	28		
6	Mill. ....	Cross in Vega av. to cr's in Barber av.	353		
6	Morse avenue. ....	T in Euclid avenue, south.....	40		
6	Marion. ....	T in Greenwood street to.....			
6		319 feet west of Sked street.....	1,203		
6	Madison. ....	Across Euclid avenue.....	96		
6	Olive. ....	T in Euclid a. 24 ft. N. of S. L. of Curt's	881		
6	Professor. ....	Cross in College st. to N. L. of same.	28		
6	Park Place. ....	T in Euclid avenue, north.....	35		
6	Russell. ....	T in Euclid av. to N. L. of Euclid av.	35		
6	Sibley. ....	T in Willson avenue, west.....	450		
6	Sibley. ....	Cross in Kennard st. to W. L. of same	37		
6	Sibley. ....	T in Sterling av. to W. L. of Cleve st.	1,129		
6	Scranton avenue. ....	Cross in Clark av., north.....	554		
6	St. Paul. ....	T in Detroit street, north.....	40		
6	Tilden avenue. ....	T in Euclid avenue, north.....	35		
6	Taylor. ....	Across Detroit street.....	68		
6	Taylor. ....	T in bridge to N. L. of Franklin st.	1,613		
6	Woodbine. ....	T in Fulton street, west.....	26		
6	White. ....	T in Willson avenue, west.....	388		
6	Weddell. ....	T in Detroit st. to N. L. of Detroit st.	40		
6	Waverly. ....	T in Detroit street, south.....	24		
6	Wilket. ....	Lorain street, south.....	22		
6	Whitman. ....	T in Harbor st. to W. L. of Kentucky	1,165		
6	Washington. ....	In Hanover street.....	16		
6	Wasson. ....	Cross in Lake st. to N. L. of Lake st.	52		
6	York. ....	Across Vestry street.....	60		
6	York. ....	N. L. of Lorain to cross in Carroll st.	425		
6		Hydrant and Cistern connections ...	406		
				24,859	
4	Belmont. ....	Woodland ave. to Orange street.....	318		
4	Bond. ....	Between 8 in. and 4 in. pipes in Superior	18		
4	College. ....	Cr's in Prof'r st. to W. L. of Univ'ty.	494		
4	Carroll. ....	Cross in York st., east.....	16		
4	Chapel. ....	From 16 ft. north of Olive st., north..	117		
4	Church. ....	Cross in Hanover street, west.....	415		
4	Fulton court. ....	T in Fulton street, west.....	26		
4	Huntington. ....	Prospect to Garden.....	838		
4	Hanover. ....	S. L. of Washington to N. L. Division	460		
4	Hamilton. ....	340 ft. w. of Alabama to 230 ft. e. Ross	253		
4	Hamilton. ....	E. L. of Sterling to cross in Lawrence	839		
4	Lawrence. ....	Cross in Hamilton st. south.....	183		
4	Liberal. ....	N. L. of Broadway to T. in Cherry...	478		
4	Mill. ....	Cross in Barber avenue, north.....	351		
4	Noble Alley. ....	T in Ontario street, west.....	40		
4	Summit. ....	From 4 ft. pipe in Seneca st., east.....	150		
4	Superior. ....	Between 8 in. and 4 in. pipes at east			
4		line of public square.....	20		
4	Vestry. ....	In York street.....	25		
4	Wood. ....	N. line of Lake to Summit street.....	271		
4	Warden. ....	T in Columbus street, east.....	42		
4	Walton. ....	Cross in Columbus street, east.....	42		
4	Willey. ....	Pearl to Columbus streets.....	300		
4		Hydrant and cistern connections.....	1,777		
				8,471	
3	Follet court. ....	T in Tracy street, west.....	201		
3	Wallingford. ....	S. line Woodland avenue, south.....	317		
3	Wheeler place. ....	T in Eagle street, south.....	177		
				694	

Relaid.

## SCHEDULE

Of pipe taken up and relaid in 1875:

Diameter of pipe taken up.	Diameter of pipe relaid.	Street.	Between what Points.	Feet laid.	Total.	Remarks.
*4	8	Champlain..	Cross in Seneca to cross in Ontario.	567	.....	
4	6	Champlain..	Cross in Seneca west.....	40	.....	
*4	4	Huntington..	Prospect street to Garden.....	838	.....	
4	6	Irving.....	T in Broadway north.....	447	.....	
4	8	Seneca.....	Cross in Superior to cross in Mich.	765	.....	
4	6	Long.....	T in Seneca west.....	20	.....	
4	6	Michigan.....	Cross in Seneca east.....	26	.....	
3	4	Summit.....	Seneca street pipe east.....	150	.....	
4	6	Wason.....	Cross in Lake street to north line..	52	.....	
*4	4	Willey.....	Columbus to Pearl.....	300	.....	
					3,205	

\*Cement.

## TOTAL PIPE LAID TO DEC. 31, 1875.

Diameter of pipe in inches.	36	30	24	20	16	12	10	8	6	4	3
Previous to 1875.	1,630	13,039	10,254	10,913	12,514	5,508	43,556	51,847	152,574	111,814	13,412
Laid in 1875.....						1,064	14,422	10,645	24,859	8,471	694
Total .....	1,630	13,039	10,254	10,913	12,514	6,562	57,978	62,492	177,433	120,285	14,106
Taken up in '75.....										3,065	150
Total in use. ..	1,630	13,039	10,254	10,913	12,514	6,562	57,978	62,492	177,433	117,220	13,956
48,350						435,651					

## RECAPITULATION.

48,350 feet of supply main equal to 9 miles and 880 feet.

435,651 feet of distributing main equal to 82 miles and 2,691 feet

484,001 feet.

91 miles and 2,521 feet.

## SCHEDULE

Giving size, number and location of stop gates set in 1875.

No.	Size in Inches.	Street.	Side of Street.
1	12	Willson avenue	South line of Euclid avenue.
1	12	Willson avenue	South line of East Prospect.
2		Set in 1875.	
1	10	Columbus	South line of Walton avenue.
1	10	Clark avenue	West " Columbus.
1	10	Clark avenue	East " Hurton.
1	10	Clark avenue	East " Pollock.
1	10	Clark avenue	East " Rhodes avenue.
1	10	Clark avenue	East " Hitchcock.
1	10	Euclid avenue	East " Willson avenue.
1	10	Euclid avenue	235 feet east of Olive.
1	10	Euclid avenue	East line of Danham.
1	10	Euclid avenue	East " Ruesch.
1	10	Euclid avenue	East " Highland.
1	10	Euclid avenue	East " Madison.
1	10	Euclid avenue	East " Tilden.
1	10	Lincoln avenue	South " Euclid avenue.
1	10	Oakland	North " Detroit.
1	10	Scott	South " Detroit.
1	10	Superior	West " Willson avenue.
1	10	Willson avenue	North " Euclid avenue.
1	10	Willson avenue	South " Curtiss avenue.
1	10	Willson avenue	South " Quimby.
1	10	Willson avenue	South " Payne avenue.
1	10	Willson avenue	365 feet north of White avenue.
1	10	Willson avenue	South line of Superior.
23		Total set in 1875.	
1	8	Bank	Con't'n valve bet. 4 in. & 8 in. pipes
1	8	Champlain	East line of Seneca.
1	8	Champlain	West " Ontario.
1	8	Detroit	West " Kentucky.
1	8	Detroit	West " Taylor.
1	8	Detroit	East " Birch.
1	8	Detroit	West " Courtland.
1	8	Detroit	West " Waverly.
1	8	East Prospect	East " Willson avenue.
1	8	Seneca	North " Superior.
1	8	Seneca	North " Superior.
1	8	Seneca	South " Champlain.
1	8	Seneca	In Superior bet. 8 in. and 4 in. pipes.
1	8	Seneca	In Superior bet. 4 in. and 20 in. pipes.
1	8	Superior	East line of Willson avenue.
1	8	Superior	West " Erie.
1	8	Superior	West " Bond.
1	8	Superior	West " Public Square.
1	8	Superior	West " Bank.
1	8	Superior	East " Water.
1	8	Water	Bet. 20 in. and 4 in. pipes in Superior.
1	8	Water	Bet. 4 in. and 8 in. pipes in Superior.
1	8	Willson avenue	North line of B.
1	8	Willson avenue	South " Prosser.
1	8	Willson avenue	North " Julia.
1	8	Willson avenue	South " St. Clair.
26		Total 8 inch valves set in 1875.	
1	6	Alabama	South line of Superior.
1	6	Alabama	North " Payne avenue.
1	6	Arlington	North " Garden.
1	6	Arlington	South " Cedar avenue.
1	6	Burnham	South " Scovill avenue.
1	6	Birch	South " Detroit.
1	6	Bond	South " Superior.
1	6	Burton	North " Cloud.
1	6	Burton	North " Clark avenue.

## SCHEDULE

Giving size, number and location of stop gates set in 1875.—  
Continued.

No.	Size in Inches.	Street.	Side of Street.
1	6	Burton	North line of Cook.
1	6	Cedar avenue	West line of Kennard.
1	6	Courtland	South line of Detroit.
1	6	Courtland	North line of Franklin.
1	6	Champlain	West line of Seneca.
1	6	Clark avenue	West line of Scranton.
1	6	Clark avenue	East line of Scranton.
1	6	Clark avenue	West line of Gault.
1	6	Clark avenue	West line of Jennings.
1	6	Darc avenue	South line of Detroit.
1	6	Dibble avenue	East line Willson.
1	6	Dunham avenue	North line of Euclid.
1	6	Dunham avenue	North line of Hough.
1	6	Dunham avenue	South line of Hough.
1	6	Erin avenue	West of Columbus.
1	6	Giddings	North line of Euclid.
1	6	Giddings	South line of Euclid.
1	6	Harmon	South line of Scoville.
1	6	Harbor	North line of John street.
1	6	Highland	North line of Euclid.
1	6	Harbor	North line of Bridge.
1	6	Irving	North line of Broadway.
1	6	Jersey	East line of Fulton.
1	6	Jennings	North line of Clark.
1	6	Kennard	North line of Sibley.
1	6	Kennard	South line of Cedar.
1	6	Kentucky	North line of Detroit.
1	6	Kentucky	South line of Detroit.
1	6	Lawrence	North line of Superior.
1	6	Lena	East line of Willson.
1	6	Luther	East line of Willson.
1	6	Marion	West line of Greenwood.
1	6	Marion	East line of Sked.
1	6	Michigan	East line of Seneca.
1	6	Morse	South line of Euclid.
1	6	Madison	North line of Euclid.
1	6	Madison	South line of Euclid.
1	6	Mill	North line of Vega ave.
1	6	Mill	South line of Barber.
1	6	Olive	North line of Euclid.
1	6	Olive	South line of Curtiss.
1	6	Russell	North line of Euclid.
1	6	St. Paul	North line of Detroit.
1	6	Sibley	West line of Willson.
1	6	Sibley	West line of Sterling.
1	6	Sibley	West line of Greenwood.
1	6	Scranton	North line of Clark.
1	6	Taylor	South line of Franklin.
1	6	Taylor	North line of Bridge.
1	6	Taylor	North line of Detroit.
1	6	Taylor	South line of Detroit.
1	6	Whitman	East line of Harbor.
1	6	Whitman	East line of Randall.
1	6	Whitman	West line of Kentucky.
1	6	Wason	North line of Lake.
1	6	Woodbine	West line of Fulton.
1	6	Weddell	North line of Detroit.
1	6	White	East line of Willson.
1	6	Waverly	South line of Detroit.
25	6	Valves for hydrant and cistern connections.	
93	6	Valves set in 1875.	

## SCHEDULE

Giving size, number and location of stop gates set in 1875.—  
Continued.

No.	Size in inches.	Street.	Side of Street.
1	4	Belmont.....	North line of Orange.
1	4	Bond.....	North line of Superior.
1	4	College.....	East line of Professor.
1	4	Church.....	West line of Hanover.
1	4	Fulton Court.....	West line of Fulton.
1	4	Hanover.....	North line of Washington.
1	4	Hanover.....	South line of Division.
1	4	Hamilton.....	West line of Buel.
1	4	Hamilton.....	East line of Sterling.
1	4	Hamilton.....	West line of Lawrence.
1	4	Liberal.....	South line of Cherry.
1	4	Lawrence.....	South line of Hamilton.
1	4	Mill.....	North line of Barber.
1	4	Noble alley.....	West line of Ontario.
1	4	Summit.....	East line of Seneca.
1	4	Superior.....	West line of Bond.
1	4	Superior.....	Bet. 4 in. & 8 in. near E. L. Pub. Sqr
1	4	Superior.....	West line of Water.
1	4	Wood.....	South line of Summit.
125	4	Valves for hydrant and cistern connections.	
144	4	Valves set in 1875.	
1	3	Follet Court.....	
1	3	Wheller Place.....	
1	3	Valve for hydrant for Wallingford Court.	
3	8	Valves set in 1875.	

## RECAPITULATION.

Water way in inches.....	36	30	24	20	16	12	10	8	6	4	3	Total.
						2	23	26	93	144	3	291

## TOTAL NUMBER OF STOP GATES SET IN STREETS TO DECEMBER 31st, 1875.

Water way in inches.....	36	30	24	20	16	12	10	8	6	4	3	Total.
Set previous to 1875.....	1	12	7	12	19	10	57	83	291	479	280	1,254
Set in 1875.....						2	23	26	93	144	3	291
Total.....	1	12	7	12	19	12	80	109	387	623	283	1,545
Taken out in 1875.....											17	17
Total in use.....	1	12	7	12	19	12	80	109	387	623	266	1,528

## FIRE HYDRANTS SET IN 1875.

No.	Street.	Feet.	Location.	Side.
1	Alabama.....	300	South of Superior.....	East.
1	Alabama.....	334	North of Payne avenue.....	East.
1	Alabama.....	17	North of north line of Payne avenue.....	East.
1	Arlington.....	458	North of Garden.....	East.
1	Arlington.....	501	South of Cedar avenue.....	East.
1	Arlington.....	33	South of Cedar avenue.....	East.
1	Burton.....	270	South of Buckley.....	East.
1	Burton.....	28	South of Train.....	East.
1	Burton.....	.....	At Cloud.....	East.
1	Burton.....	.....	At Kirtland.....	East.
1	Burnham.....	460	South of Scovill avenue.....	West.
1	Belmont.....	.....	At Orange.....	East.
1	Clark.....	218	East of Scranton avenue.....	South.
1	Clark.....	.....	At Milton.....	South.
1	Clark.....	.....	At Guitto.....	South.
1	Clark.....	.....	At Newell.....	South.
1	Clark.....	.....	At Columbus.....	South.
1	Clark.....	181	West of Pleasant.....	South.
1	Clark.....	.....	At Rhodes.....	South.
1	Clark.....	329	West of Rhodes.....	South.
1	Clark.....	.....	At Clifford.....	South.
1	Clark.....	.....	At Burton.....	South.
1	Cedar.....	222	East of Case avenue.....	South.
1	Cedar.....	.....	At Kennard.....	North.
1	Courtland.....	361	South of Detroit.....	West.
1	College.....	.....	At University.....	North.
1	Champlain.....	205	West of Ontario.....	South.
1	Champlain.....	.....	At Ontario.....	North.
1	Detroit.....	353	West of Kentucky.....	South.
1	Detroit.....	303	West of Taylor.....	South.
1	Detroit.....	.....	At Birch.....	North.
1	Detroit.....	138	West of Dare.....	South.
1	Detroit.....	173	East of Scott.....	South.
1	Detroit.....	89	West of Scott.....	South.
1	Detroit.....	210	West of Waverly.....	South.
1	Eagle.....	.....	At Wheller Place.....	South.
1	Dunham.....	357	North of Euclid.....	East.
1	Dunham.....	111	South of Curtiss.....	East.
1	Dunham.....	198	North of Curtiss.....	East.
1	Dunham.....	.....	At Hough avenue.....	East.
1	Euclid.....	241	West of Olive.....	North.
1	Euclid.....	160	East of Olive.....	North.
1	Euclid.....	548	East of Olive.....	North.
1	Euclid.....	343	West of Dunham avenue.....	North.
1	Euclid.....	.....	At Dunham avenue.....	North.
1	Euclid.....	390	East of Dunham avenue.....	North.
1	Euclid.....	71	West of Russell avenue.....	North.
1	Euclid.....	281	East of Russell avenue.....	North.
1	Euclid.....	172	West of Highland.....	North.
1	Euclid.....	191	East of Highland.....	North.
1	Euclid.....	56	West of Morse avenue.....	North.
1	Euclid.....	149	West of Madison avenue.....	North.
1	Euclid.....	142	West of Park Place.....	North.
1	Euclid.....	89	West of Tilden.....	North.
1	Erie.....	77	North of Bolivar.....	East.
1	Forest.....	21	South of Scovill avenue.....	East.
1	Franklin.....	90	East of angle at Russia.....	South.
1	Greenwood.....	228	South of Scovill avenue.....	East.
1	Harmon.....	432	South of Scovill avenue.....	East.
1	Harbor.....	19	North of Whitman.....	East.
1	Harbor.....	.....	At John.....	East.
1	Hanover.....	.....	At Division.....	East.
1	Granger.....	.....	At Prospect.....	West.
1	Fairfield.....	25	East of Scranton avenue.....	North.
1	Huntington.....	204	South of Prospect.....	West.
1	Huntington.....	246	North of Garden.....	West.
1	Hamilton.....	114	East of Buell.....	South.
1	Hamilton.....	306	West of Buell.....	South.
1	Hamilton.....	319	West of Lawrence.....	South.
1	Irving.....	192	North of Broadway ex.....	East.
1	Jennings.....	140	North of Clark avenue.....	West.

## FIRE HYDRANTS SET IN 1875.—CONTINUED.

No.	Street.	Fect.	Location.	Side.
1	Kennard	275	South of Cedar avenue	East.
1	Lawrence	38	South of Hamilton	East.
1	Lawrence	167	South of St. Clair	East.
1	Lawrence	205	North of Superior	East.
1	Liberal		At Cherry	East.
1	Michigan		At Seneca	South.
1	Mill		At Barber avenue	West.
1	Mill	321	North of Barber avenue	West.
1	Marion	109	West of Greenwood	South.
1	Marion	204	East of Sked	South.
1	Marion	214	West of Sked	South.
1	Olive	156	North of Euclid avenue	East.
1	Olive	377	South of Curtiss	East.
1	Olive	17	South of Curtiss	East.
1	Ohio	377	West of Central Place	South.
1	Superior		At Erie	North.
1	Superior	218	East of Bond	North.
1	Superior	200	West of Bond	North.
1	Superior		At Wood	North.
1	Superior	19	East side of Public Square	North.
1	Superior	30	West of Seneca	North.
1	Superior	87	East of Bank	North.
1	Superior	228	West of Bank	North.
1	Superior		At Water	North.
1	Seneca		At Long	East.
1	Seneca		At Champlain	East.
1	Seneca	10	South of Summit	East.
1	Scranton	65	North of Clark avenue	West.
1	Sibley	406	West of Willson avenue	South.
1	Sibley	289	West of Greenwood	North.
1	Sibley	83	East of Greenwood	North.
1	Taylor	208	South of Franklin	West.
1	Taylor	614	South of Franklin	West.
1	Taylor	575	North of Bridge	West.
1	Taylor	177	North of Bridge	West.
1	Willson	43	South of Euclid	West.
1	Willson		At Prospect	East.
1	Willson		At Sibley	West.
1	Willson	283	North of Euclid avenue	West.
1	Willson	721	North of Euclid avenue	West.
1	Willson	314	South of Mason	West.
1	Willson		At Hough avenue	West.
1	Willson		At Quimby	West.
1	Willson	42	South of Moses	West.
1	Willson		At Lena avenue	West.
1	Willson		At Sixth avenue	West.
1	Willson		At White avenue	West.
1	Willson	354	North of White avenue	West.
1	Willson		At Luther	West.
1	Willson		At Dibble	West.
1	Willson		At Superior	West.
1	Willson	371	North of Superior	West.
1	Willson	331	South of Prosser	West.
1	Willson		At south line of Kindsvater	West.
1	Willson	26	South of St. Clair	West.
1	Willson	64	North of Ensign	East.
1	Willson		At Diamond Park	East.
1	Willson		At Julia street	East.
1	White	330	East of Willson avenue	South.
1	Whitman	21	West of Randall	South.
1	Whitman	273	East of Randall	South.
1	Whitman	7	West of Kentucky	South.
1	Wood		At Summit	West.
1	Wallingford court	317	South of Woodland	East.
1	West River		Northwest corner of Main	West.
136	Set in 1875			
529	Set previous to 1875			
12	Changed in 1875			
663	Total number in use			



## HYDRANTS CHANGED.

No.	Streets.	Feet.	Location.	Water way.		Side.
				From	To.	
1	Champlain.....		At Ontario.....	3	6	North.
1	Eagle.....		At Wheller Place.....	3	4	South.
1	Erie.....		Hollvar.....	3	4	East.
1	Fairfield.....	25	East of Scranton.....	3	4	North.
1	Granger.....		At Prospect.....	3	4	West.
1	Huntington.....	246	North of Garden.....	3	4	West.
1	Irving.....	192	North of Broadway.....	3	4	East.
1	Michigan.....		At Seneca.....	3	4	East.
1	Ohio.....	377	West of Central Place.....	3	4	South.
1	Seneca.....		At Champlain.....	3	6	East.
1	Seneca.....	10	South of Summit.....	3	4	East.
1	West River.....		At northwest corner of Main.....	3	4	East.
12	Total fire hydrants changed in 1875.					

N. B.—The Lowry Hydrant at Superior and Water streets was taken up.

## FIRE CISTERNS CONNECTED.

No.	Streets.	Location.	Remarks.
1	Bond.....	At Superior.....	Double connection.
1	Bank.....	At Superior.....	Double connection.
1	Cedar.....	At Cleve.....	Connection enlarged.
1	Courtland.....	At Detroit.....	
1	Custead.....	At Euclid avenue.....	
1	Erie.....	At Euclid avenue.....	Connection enlarged.
1	Giddings avenue.....	At Euclid avenue.....	
1	Huron.....	At Prospect.....	Connection enlarged.
1	Ontario.....	At St. Clair.....	Connection enlarged.
1	Prospect.....	At Ontario.....	Connection enlarged.
1	Pleasant.....	At Clark avenue.....	Connection enlarged.
1	Superior.....	West line of Public Square.....	Double connection.
1	Taylor.....	At Detroit.....	
1	Water.....	At St. Clair.....	Connection enlarged.
14	Total fire cisterns connected.		

## FIRE CISTERNS DISCONNECTED.

1	Cedar avenue.....	At Sterling avenue.
1	Scovill avenue.....	At Forest street.
2	Total fire cisterns disconnected.	

## I N V E N T O R Y

Of Tools, material and Furniture, at Pumping Works, January  
1st, 1876.

3 thermometers,	8 brass oil cans,
1 barometer,	7 tin oil cans,
100 lbs. cotton waste,	1 three gallon tin measure,
125 lbs. of white lead,	2 one gallon tin measures,
25 lbs. of red lead,	2 quart measures,
2 gallons of linseed oil,	2 tin funnels,
50 feet of $\frac{1}{4}$ inch rubber hose,	2 tin tallow kettles,
1 hand pump, galvanized iron,	1 tallow kettle and furnace,
5 coal wheelbarrows,	5 stoves,
1 carpenter's work bench,	3 coal scuttles,
1 hand-saw,	2 stove shovels,
1 jack plane,	1 knife frame and knife,
1 moulding plane,	2 knives, (common),
1 two inch chisel.	4 engine record books,
1 one and one-half inch gauge.	1 engine indicator complete,
1 iron square,	2 writing desks,
1 hand brace,	1 writing desk stand,
7 bits for same,	2 drawing tables,
1 hand axe,	4 common tables.
1 club axe,	4 arm chairs,
1 oil stone,	12 common chairs,
2 pairs compasses,	3 cupboards and closets for tools,
1 pair of calipers,	1 book case with drawers,
1 grind stone,	2 vise benches,
1 drilling machine,	3 bench vises,
1 hand drill brace geared,	1 hand vise,
7 bits for same,	1 small portable vice,
2 screw drivers,	6 files,
1 one and one half inch screw tap,	13 cold chisels,
1 one and one fourth inch screw tap	24 drills,
2 one and one half inch screw taps,	8 caulking tools,
2 one inch screw taps,	2 drills for boring stone,
2 seven-eighth inch screw taps,	1 reamer for boring stone,

1 three fourth inch screw tap,	1 hand hammer,
1 stock, 4 pairs dies,	2 sledges,
1 stock 2 pairs dies,	4 screw wrenches,
7 small taps for same,	3 copper hammers,
8 tap wrenches,	1 pair of 8 inch blocks,
1 ratchet drill brace,	1 pair of 6 inch blocks,
6 socket wrenches,	2 single 17 inch blocks,
5 claw wrenches,	1 single 14 inch block,
2 key wrenches,	19 fathoms of 3 inch rope,
3 valve or gate wrenches,	26 fathoms of 3 inch rope,
1 drill post,	22 fathoms of 3 inch rope,
4 pairs gas pipe tongs,	9 fathoms of 2½ inch rope,
1 blacksmith's forge,	33 fathoms of 4½ inch rope,
2 blacksmith's anvils,	15 fathoms of 4½ inch rope,
6 pairs blacksmith's tongs,	26 fathoms of 3½ inch rope,
2 blacksmith's chisels,	28 fathoms of 3½ inch rope,
11 pairs eye bolts,	66 fathoms of 6 inch rope,
142 bolts and nuts for pump work,	10 fathoms of 3 inch rope,
2 screws for raising pump valves.	11 fathoms of 3½ inch rope,
1 lifting screw complete,	13 fathoms of 3½ inch rope,
1 ratchet lever for same,	2 rope lockers,
1 hack saw,	2 pine way timbers 12x12,
1 pair 13 inch blocks,	3 pine timbers 8x8 30 feet long,
2 pairs 9 inch blocks,	2 pairs of short sheer timbers,
2,200 tons of coal,	200 feet of ½ inch iron chain,
135 gallons of cylinder oil,	1 lead ladle,
45 gallons of lard oil,	1 set of ½ inch steel figures and stamps,
60 gallons of Mecca oil,	1 platform scale 600 pounds,
700 pounds of tallow,	1 steel yard scale 2,000 pounds,
150 pounds of hemp packing,	239 3½ feet grate bars,
4 air pump rubber valves,	260 fire brick,
7½ pounds of tappet leather,	3 barrels of fire brick,
185 feet of 2 inch leather hose, (bad)	2 minute glasses,
2 hose pipes,	out of use (oil lamp),
1 brass valve for cold water pump,	2 chandeliers,
2 new valves for main pump,	2 bracket lamps,
1 stop valve chamber, and valve for main pump,	1 table lamp,
1 set gear for same,	3 boiler room lamps,
2 pieces of discharge for main pump,	2 brass valves of cold water pumps,
1 blank flange for stand pipe branch,	1,200 pounds of scrap cast iron,
13 brass hand lamps,	1 stop valve chamber of main pump.
5 globe lanterns,	1 piece of discharge pipe.
1 square lantern,	

## SCHEDULE

Showing the miscellaneous material on hand at the Reservoir.

1 thirty inch wrench,	1 twenty-four inch pipe 10 ft. long.
1 six inch wrench,	1 twenty-four inch pipe 8 feet long,
1 twenty inch wrench,	5 ten inch pipes,
2 sixteen inch sleeves,	1 twelve inch pipe,
2 twenty inch sleeves,	8 feet of 12 inch pipe,
2 twenty-four inch sleeves,	43 feet of 10 inch pipe,
4 thirty inch sleeves,	6 eight inch pipes,
2 ten inch sleeves,	2 eight inch pipes 9 feet long,
3 six inch sleeves,	2 twenty inch pipes,
3 four inch sleeves,	1 sixteen inch pipe,
2 pairs 30 inch clamps,	45 feet of 8 inch pipe in pieces
3 pairs 36 inch clamps,	from 5 to 8 feet long,
4 pairs 24 inch clamps,	10 six inch pipes,
2 pairs 20 inch clamps,	12 four inch pipes,
5 pairs 16 inch clamps,	48 feet of 4 inch pipe in pieces 8
2 pairs 20 inch socket clamps,	feet long,
1 pair 16 inch socket clamps,	2 three inch pipes,
2 pairs 24 inch socket clamps,	11 feet of 3 inch pipe,
1 twenty inch cap,	1 twenty-four inch valve,
1 twelve inch cap,	1 twenty-four inch valve (Scowden),
1 thirty inch cap,	2 twenty inch valves (Scowden),
2 thirty inch curves,	1 three inch valve,
2 thirty inch, one half curves,	2 lead pots,
6 sixteen inch curves,	3 melting ladles,
2 eight inch curves,	1 set of calking tools,
3 four inch elbows,	1 tool box,
2 eight inch crosses,	20 picks,
3 six inch crosses,	1 axe,
2 four inch crosses,	1 sledge,
4 four inch cement crosses,	1 reservoir and hydrant wrench,
4 four inch cement tees,	1 pair of calipers,
1 eight inch tee,	4 six inch wood plugs,
3 six inch tees,	2 water pails,
1 eight to four inch tee,	1 fifty foot tape line,
2 six to four inch tees,	1 grindstone,

1 thirty-six to twenty-four inch reducer,	2 scythes,
6 twelve to six inch reducers,	1 sickle,
1 twenty-four to twenty inch reducer.	5 hose,
1 four to three inch reducer,	1 hay rake,
9 thirty-six inch pipes,	1 lawn mower,
1 thirty inch pipe 8 feet long,	1 monkey wrench,
1 thirty inch pipe 8 feet long,	1 manure fork,
5 thirty inch pipes,	2 lamp posts,
3 thirty inch pipes 3 feet long,	2 valve boxes,
8 twenty-four inch pipes,	3 tons scrap iron (estimated),
	1 marking brand, C. W. W.

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#### SCHEDULE

Showing the miscellaneous stock and material on hand at the Engine House.

4 hand derricks,	1 pile ram,
1 large derrick with gearing,	2 sections of tunnel shaft,
4 wheelbarrows,	1 twenty inch pipe 7 feet long,
1 well pulley,	1 centrifugal pump and fixtures,
1 double block,	1 pony engine and fixtures,
1 maul,	2 thirty-six inch pipes,
1 scoop,	4 thirty-six inch sleeves,
1 melting ladle,	1 thirty inch sleeve,
2 caps for sheet piling,	2 twenty-four inch sleeves,
4 eye bolts for gate well covering,	1 thirty inch curve,
24 sections of aqueduct gates,	1 thirty to twenty-four inch reducer.
1 pair of iron pulley blocks,	2 crowbars,
2 pieces of 6 inch driving pipe 8 feet long,	1 lantern,

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#### SCHEDULE

Showing miscellaneous material on hand at Crib.

2 sections of tunnel shaft,	1 large monkey wrench,
1 sail and row boat,	1 crow bar,
2 lanterns,	8 tons of coal,
4 oil cans,	2 tons of scrap iron (estimated),
1 pair of pulley blocks for boat hoist,	1 twenty-five foot flag stars and stripes,
1 Fresnal light of 6th order, for light house,	1 grindstone,
1 heavy sledge,	1 earth closet.

## SCHEDULE

Showing miscellaneous material on hand at store room.

1 ten to eight inch tee,	12 pails
3 ten to six inch tees,	2 large derricks and gearing,
2 eight inch tees,	3 furnaces for melting lead.
2 six inch tees,	4 melting pots,
5 four inch tees,	3 melting ladles,
1 eight inch sprinkler tee,	3 sets of calking tools,
2 six inch sprinkler tees,	2 long handle shovels,
3 four inch sprinkler tees,	4 hand lanterns,
5 three inch sprinkler tees,	3 three inch goose necks for hydrants
1 six to four inch tee,	25 lbs. of white lead.
1 ten to 8 inch cross,	3 yards of duck cloth,
2 eight inch crosses,	3 oil cans,
3 six inch crosses,	3 street lamps,
6 four inch crosses,	2 sledges,
7 eight inch, one-eighth curves,	1 axe,
9 six inch, one-eighth curves.	1 saw.
4 four inch curves,	2 hammers,
3 three inch curves,	600 lbs of lead,
3 six inch reversed crosses,	2 crowbars,
8 six inch elbows,	3 extra top valve box frames.
6 four inch elbows,	4 three inch brass cocks,
5 three inch elbows,	10 lbs. rubber gaskets for hydrants.
5 ten to six inch reducers,	1 double block pulley,
6 eight to four inch reducers,	1 set double pulley blocks, with ropes
9 six to four inch reducers,	2 sets of chain for pipe laying,
13 eight to six inch reducers,	1 ladder,
4 four to three inch reducers,	1 derrick for test pits,
1 four to two inch reducer,	116 feet pipe drill rods,
5 twelve inch sleeves,	1 pair tongs,
6 ten inch sleeves,	2 pair pipe tongs,
9 eight inch sleeves,	1 sprinkler box,
10 six inch sleeves,	2 sprinkler box covers,
9 four inch sleeves,	6 two inch nipples,
5 three inch sleeves,	24 feet 2½ inch pipe,

4 pair 12 inch clamps,	1 drill auger for test pit,
7 pairs 10 inch clamps,,	1 rimming augur for test pit,
6 eight inch clamps,	1 twenty-inch wrench,
6 six inch clamps,	2 sixteen-inch wrenches,
• 5 four inch clamps,	1 thirty-inch wrench,
5 three inch clamps,	3 six-inch wrenches,
1 twelve inch pipe,	3 claw wrenches,
21 feet of 10 inch pipe,	1 three-inch wrench,
5 eight inch pipes,	1 air cock,
95 feet of 8 inch pipe in pieces,	3 monkey wrenches,
6 six inch pipes,	1 pair grappling tongs,
70 feet of 6 inch pipe in pieces,	2 sets Fairbanks' scales,
24 four inch pipes,	1 two-inch tin pump,
140 feet of 4 inch pipe in pieces,	1 wheelbarrow,
5 three inch pipes,	2 ladle rests,
26 feet of 3 inch pipe in pieces.	1 sprinkler wrench,
5 cylinder valve boxes,	3 hydrant wrenches.
4 No. 1 valve boxes,	1 reservoir wrench,
2 valve boxes,	1 maul,
3 top and bottom valve box frames,	300 pounds brass (estimated),
5 eight inch valves,	2 tape lines,
1 six inch valve,	2 store room sheds,
5 four inch valves,	1 inch water meter,
11 three inch valves,	1 $\frac{3}{4}$ inch water meter,
6 three inch Manning valves,	2 two-inch water meters,
7 six inch hydrants (Wood's),	2 $1\frac{1}{2}$ inch water meters,
2 four inch hydrants (Wood's),	12 wood plugs of different sizes,
1 four inch hydrant (Wood's),	26 picks,
8 three inch single hydrants,	3 sets calking tools,
1 Lowry hydrant,	1 pair calipers,
2 barrels cement	1 crowbar.

## SCHEDULE

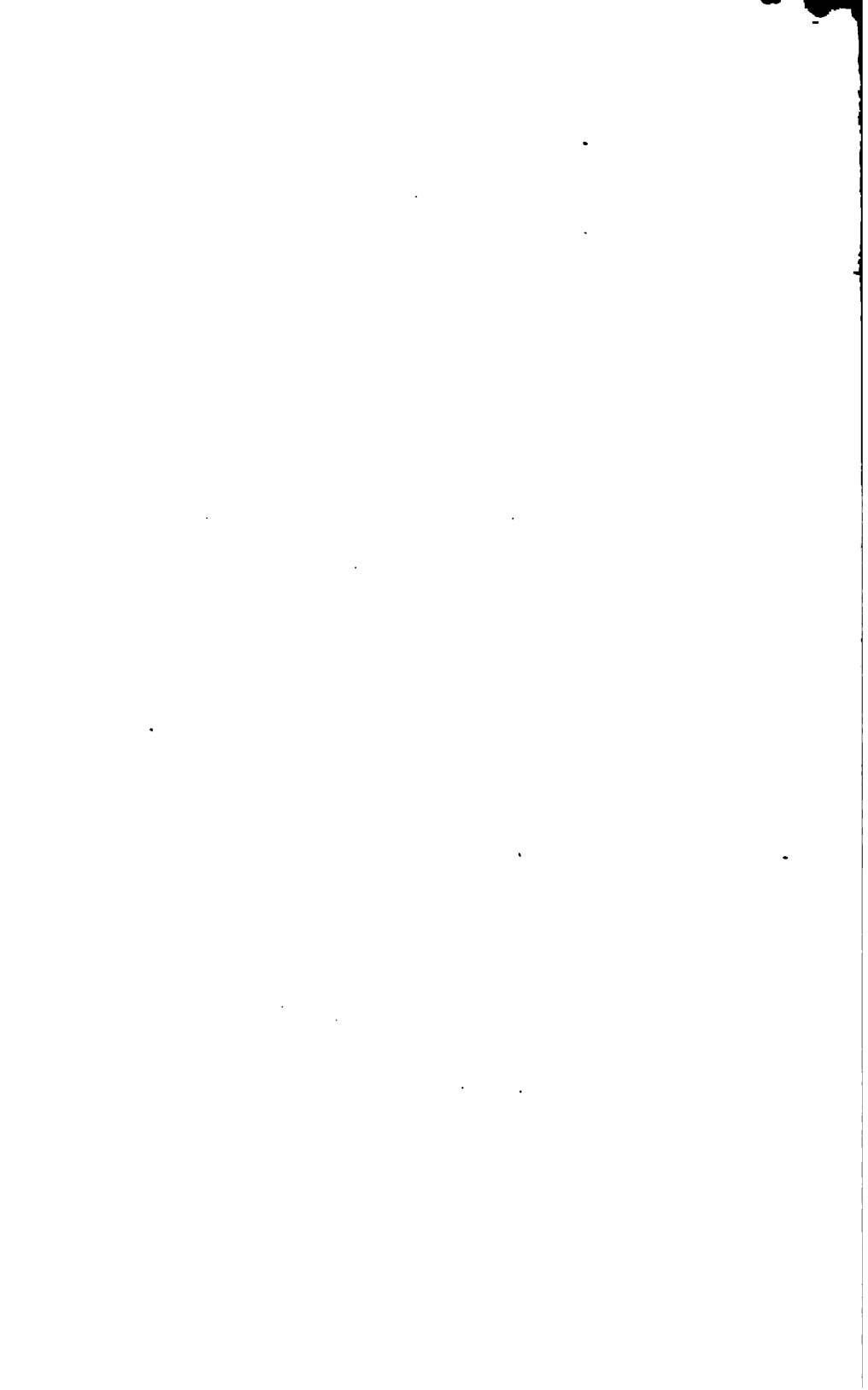
Showing miscellaneous materials on hand at Office.

3 desks,	2 pickets,
4 tables,	2 tape lines,
1 bureau for drawings,	2 picks,
1 safe,	1 shovel,
1 office counter,	1 ten-inch drill clamp,
16 chairs,	1 eight-inch drill clamp,
1 clock,	1 six-inch drill clamp,
2 large coal boxes,	4 stop-cock wrenches,
1 ton coal,	1 four-inch wrench,
1 drawing table,	1 six-inch wrench,
8 drawing boards,	1 three-inch wrench,
7 picture frames,	1 three-inch claw wrench,
1 base burner stove,	2 pairs tongs,
58 yards carpet,	2 sprinkler wrenches,
131 yards linoleum carpet,	1 set tapping tools and bag,
1 roll drawing paper,	2 street washer keys,
4 maps,	3 coal hods,
Plans, maps, sketches, etc.,	16 balls twine,
2 door mats,	6 sprinkler couplings,
1 barometer,	5 lanterns.
1 double gas bracket,	1 model of crib,
1 double gas chandelier,	83 stop-cock numbers,
10 single gas light brackets,	1 monkey wrench,
3 books, permit, cash and ledger,	2 fire hydrant wrenches,
1 book, pipe record,	1 cupboard for papers and reports,
1 letter scale,	1 brace,
4 bill books,	19 cement ferules,
1 transit,	250 brass ferrules,
1 level rod,	1 water cooler and stand,
1 level,	1 pair two inch pipe tongs.
2 100-foot chains,	









14 E. Price C. 6

TWENTY-FIRST ANNUAL



OF THE

BOARD OF TRUSTEES

OF

# WATER WORKS

TO THE

CITY COUNCIL OF CLEVELAND,

TOGETHER WITH THE

REPORTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1876.

CLEVELAND, O.:

A. W. FAIRBANKS & CO., PRINTERS, HERALD OFFICE.  
1877.

DUPLICATE EXCHANGE 2 AUG. 1901

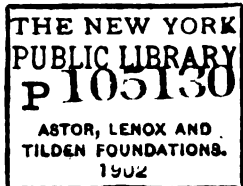
M. 500. CIVIL ENGINEERS



TWENTY-FIRST ANNUAL REPORT  
OF THE  
BOARD OF TRUSTEES  
OF  
WATER WORKS  
TO THE  
CITY COUNCIL OF CLEVELAND,  
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1877.



# REPORT OF TRUSTEES OF WATER WORKS.

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*To the Honorable City Council of Cleveland :*

GENTLEMEN—In compliance with law, we respectfully submit our report for the year 1876.

The condition of this department is so fully shown in the reports and tabular statements of the appointed officers, herewith submitted, that any further remarks seem to us almost unnecessary.

The report of the Secretary shows the receipts and expenditures for the year, leaving a balance of cash in the city treasury, December 31st, 1876, of forty-two thousand eight hundred and ninety-dollars and one cent. There are no liabilities except the final payment of seven thousand five hundred dollars on the Worthington engine, payable at the time it is accepted by the Board.

In the report of the Superintendent and Engineer will be found a comprehensive statement of the construction of the inland extension of the tunnel, with a description of the difficulties encountered and overcome. It is gratifying in this connection to be able to state that the work was completed without accident or delay, and that no work was done requiring the payment of extras. The total cost was less than the amount estimated and reported to us by our Engineer previous to the letting of the work.

The report of the Engineer in charge of the pumping works, regarding the condition of the machinery and boilers under his care, is so full and complete that we need only to call your attention to the statements and recommendations therein contained.



It is proposed during the coming season to erect suitable fences to enclose the engine house grounds, and to grade and otherwise improve the lot. It is also proposed to build a suitable coal dock, extending across the whole river front, and in connection therewith to erect proper coal sheds, which action we trust will receive the approval of your honorable body.

Your attention is called to the statement regarding the disabling of the main pipe crossing the river at Superior street, and our action subsequent thereto, resulting in a determination to substitute a larger pipe for the old one. In the new pipe we have had constructed, provision is made for connecting the present main, and at some future time, when the necessities of the city shall require it, the connection of another main thirty inches in diameter. This pipe is to be laid twenty-five feet below the surface of the river, or eight feet deeper than the one removed.

The length of distributing pipe of all sizes laid during the year was nearly twelve and three-quarter miles. A large portion of it was laid through unimproved streets that will not yield any revenue for the present, but in many cases these unproductive lines of pipe serve as feeders for other productive streets; many of them also serve as links in completing circuits in different parts of the city.

As foreshadowed in our last annual report, we have caused plans to be made for a superstructure of stone, bound together in the most substantial manner with iron, to be built on the lake crib protecting the inlet to the tunnel. We call your attention to the description of this structure as given in the report of the Superintendent and Engineer.

In conclusion, we would express our thanks for the generous aid extended to us in carrying out the improvements and making the extensions enumerated in the accompanying reports.

Respectfully submitted,

WALTER BLYTHE, PRES'T,  
P. SMITH,  
ETHAN ROGERS,

*Trustees of Water Works.*

CLEVELAND, March 16, 1877.

## SECRETARY'S REPORT.

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*To the Trustees of Water Works:*

GENTLEMEN—The cash receipts and disbursements of this department for the year 1876, including balances, are as follows:

### RECEIPTS.

For water, including permits.....	\$141,152 60
For sale \$100,000 6 per cent. water bonds, par value, 100,000 00	100,000 00
For premium on same at $\frac{5}{8}$ per cent.....	625 00
For sale of \$50,000 6 per cent. water bonds, par value 50,000 00	50,000 00
For premium on same at 2 per cent....	1,000 00
On pipe extension account.....	912 84
On general repair account.....	25 63
Cash in office December 31, 1875.....	6,296 53
	\$300,012 60

### DISBURSEMENTS.

Deposited with City Treasurer.....	\$289,601 38
Water rent refunded .....	216 73
Cash items (sprinkling certificates) transferred to	
bills receivable account .....	4,375 03
Cash in office December 31, 1876.....	5,819 46
	\$300,012 60

The expenditures on the various accounts, after deducting credits and transfers, are as follows:

Office and general expenses .....	\$ 21,443 98
Engine house expenses .....	30,037 61
General repairs .....	6,952 55
Repairs at engine house.....	9,014 31

Pipe extension. ....	\$ 95,312 20
Lake tunnel extension. ....	54,526 44
Worthington pumping engine. ....	40,000 00
Water meters. ....	3,113 28
Lake crib superstructure. ....	390 00
Construction account. ....	9,662 14
	<hr/>
	\$270,452 51

The yearly account with the City Treasurer is:

#### DEBTOR.

December 31, 1875, balance in Treasury .....	\$ 24,679 61
Deposits for the year 1876 .....	137,949 88
Proceeds sale of bonds. ....	151,625 00
Outstanding order canceled.. ....	26 50
	<hr/>
	\$314,280 99

#### CREDIT.

By bills and pay-rolls certified to the City Auditor for payment from City Treasury .....	\$271,390 98
Balance in City Treasury December 31, 1876. ....	42,890 01
	<hr/>
	\$314,280 99

#### LEDGER BALANCES, DECEMBER 31, 1876.

##### FACE OF LEDGER.

Construction. ....	\$2,279,748 06	
Worthington engines .....	40,000 00	
Lake crib superstructure .....	390 00	
Water meters .....	7,626 88	
Bills receivable .....	4,375 03	
City Treasurer .....	42,890 01	
Cash .....	5,819 46	
Bonds. ....		\$1,725,000 00
Water rent .....		602,567 49
Cleveland City .....		48,473 60
Interest and discount ....		4,808 35
	<hr/>	<hr/>
	\$2,380,849 44	\$2,380,849 44

The total cost of the Water Works, as shown in the above, is  
**\$2,327,764.94.**

It may be proper to state that an error occurred in my report for the year 1875, in giving the amount of running expenses. The expenses should have been reported \$4,513.60 less, in accordance with the ledger account; that sum having been transferred to water meter account.

Respectfully submitted,

H. C. HAWKINS,

*Secretary.*

CLEVELAND, March 1, 1877.

REPORT OF  
SUPERINTENDENT AND ENGINEER.

---

*To the Board of Trustees of Water Works :*

GENTLEMEN—The Twenty-first Annual Report of the Superintendent and Engineer is herewith respectfully submitted.

LAKE CRIB.

No repairs have been made upon the crib, excepting to stop a few small leaks in the roof. The work was done by the keeper.

LAKE TUNNEL.

The supply of water through the tunnel has been uninterrupted throughout the year, excepting for a term of twenty-two days, ending September 9th, during which time the connection was being made between the lake tunnel and the new tunnel under land, from the south end of the lake tunnel to the pumping works. While this was being done, the supply of water was drawn through the old aqueduct.

NEW LAND TUNNEL.

This work, a description of which was given in our last annual report, was commenced on the 6th day of March, and completed and in use on the 9th day of September following. The contract for doing the work was awarded to Joseph A. McDonell, and was carried on jointly by himself and brother, A. A. McDonell,

who was contractor for the lake tunnel. The experience gained by both these gentlemen while building the lake tunnel, enabled them to carry out the work in a manner very satisfactory to this department.

The contract price for doing the work was \$52,500. No extras were claimed or allowed. The sum of \$68 80 was paid Mr. McDonell, however, for additional work done about the top of the two shafts, and at the gate well connecting the east shaft with the aqueduct leading to the pump wells. The total expenditure for the work, including all incidental expenses, was \$52,742.66.

The original estimate of the cost was \$68,000, which was based upon the actual cost of the lake tunnel, allowing for reduction in price of labor and materials, but including expenses incurred in overcoming the numerous difficulties met with in that work. Fortunately no difficulties of a serious nature occurred to retard the progress of the new work, or to materially increase the expense as estimated by the contractor. Only a small amount of water was met with, and the ample pumping machinery provided was allowed to lie idle fully three-fourths of the time. Gas was found in nearly all parts of the work, the greatest quantity being at or near the shafts. Explosions of gas that accumulated along the top of the excavation were not infrequent, but were never of a serious nature; the quantity of fresh air constantly forced through the tunnel to the face of the work diluted the gas so as to render it harmless.

In sinking the shafts, various soils were passed through before reaching clay, the first layer being surface soil for a depth of about five feet. Then followed a layer of peat, under which was quicksand; below this was a layer of coarse gravel, containing many large flat stones, and between this gravel and the clay, at a depth of twenty-two feet below the surface, there was found a layer of muck mixed with sand, about two feet thick, containing many fragments of different kinds of wood and matted leaves; several specimens of coniferous woods together with maple, black walnut and oak, some of which still retained the bark, were found at this depth at both shafts. At the same level, in the west shaft, several fragments of large, well preserved bones

were found, that bore evidence of having been scoured by the action of sand and water; some of them were presented to the Kirtland Society of Natural Sciences of this city, where they may now be seen. Water was found all the way down to the clay, and was the cause of considerable trouble in sinking the shafts, but was shut out completely by sinking the iron cylinders, with which the upper portion of the shafts was lined, about seven feet into the clay.

The clay, beginning at a depth of twenty-four feet below the surface of the ground, was at first soft and yielding, but when a depth of forty feet had been reached was generally hard and tough, and would doubtless have remained in place without support until the shafts could be lined with brick work. Below the iron cylinders the shafts were carried down six feet square to their full depth, the sides being supported temporarily by oak curbing, locked together at the corners so as to be self-supporting; the center was then located on the bottom, and the excavation enlarged to ten feet in diameter and lined with twelve inches of brick masonry, advancing upward in sections of about six feet at a time, the curbing being removed only as fast as necessary for enlarging the excavation. The clay throughout the whole tunnel was of the same formation as that met with under the lake, with this exception, that more and larger sand pockets were found near the east end than under the lake; these caused a good deal of annoyance and expense to the contractor, by the soft material dropping in beyond the line of excavation, when not supported, the contract requiring all such cavities to be filled with masonry at the expense of the contractor.

Work was carried on from both shafts at the same time. From the west shaft two gangs of men were pushing the work in opposite directions, one of them towards the shore shaft of the lake tunnel, while the other gang was working eastward to meet the work advancing from the easterly shaft. The two parties working on the same line met at a point twelve hundred and eighty and one-half feet west of the east shaft, or seven hundred and ninety feet east of the west shaft, the total distance between the two shafts being two thousand and seventy and one-half feet.

The distance from the west shaft to the shore shaft of the lake tunnel is four hundred and eighty-seven and one-fourth feet, making the total length of the tunnel from the south end of the lake tunnel to the east shaft at the pumping works, two thousand five hundred and fifty-seven and three-fourths feet, which, added to the length of the lake tunnel, makes the distance from the crib to the east shaft nine thousand two hundred and nineteen and thirty-six one-hundredths feet, or twenty and sixty-four one-hundredths feet less than one and three-fourths miles.

### THE AQUEDUCT.

Since the completion of the tunnel from the shore end of the lake tunnel to the pumping works, the aqueduct through which the supply of water for the city has been drawn for the past twenty years, has been abandoned, in conformity to an agreement made with Mr S. S. Stone, across whose land the northerly and westerly end of this conduit passes. A continuous line of tunnel from the crib to the pumping works renders that structure of no future use.

### BUILDINGS AND GROUNDS.

The metal roofs of both engine houses and the stand pipe tower for the Cornish engines, have been painted with two coats of iron-ore paint. A large ventilator has been put on the roof of the new boiler house, adding greatly to the comfort of the firemen. No other improvements or repairs have been made to either of the buildings. No work has been done upon the grounds as recommended in our last annual report, principally on account of the occupancy of the ground by the contractors for the tunnel and new engines, but as no such reason can prevent the work from being done the coming season, the recommendation is again made that the grounds be graded and otherwise improved and fenced, so as to give them a more attractive appearance.

The extension of the coal dock across the whole front of the lot on the River Bed, is also recommended. The recommendation of the Engineer in charge of the pumping machinery,



regarding the erection of suitable coal sheds for the protection and preservation of the fuel stored on the premises, is approved, and authority is asked to construct such sheds at an early day.

### ENGINES AND BOILERS.

As will be seen in the table of Engine Records, the Cornish engines have pumped less than a fifth of the total quantity of water delivered during the year, the Cuyahoga engine and the new Worthington Duplex furnishing the remainder, each having pumped about the same quantity. For information regarding the repairs made to the engines and boilers, your attention is respectfully called to the report of Mr. Doty, the engineer in charge of pumping machinery, under whose watchful care and skillful management order has been brought out of the confusion he found existing when he took charge of the machinery one year ago.

The Cuyahoga engine is now undergoing extensive repairs, the cost of which cannot be ascertained until the work is complete.

The Worthington Duplex engine, contracted for September 29th, 1875, was ready for use July 18th, 1876, and was run for two weeks, when it was stopped for the purpose of putting the lagging on the steam cylinders. It has been used constantly ever since October 31st, supplying the total demand for water, without having as yet been run at more than three-fourths the number of strokes per minute it is capable of making. This engine is guaranteed to pump to the top water line of the reservoir, ten million gallons of water in twenty-four hours, with a piston speed of one hundred feet per minute, or twelve and a half double strokes of eight feet each. The displacement of the plungers at each stroke is six hundred and twenty gallons, which sum, multiplied by twelve and a half, and the product by the number of minutes in twenty-four hours, gives, as a result, eleven million gallons, or ten per cent. in excess of the quantity guaranteed, after making an allowance of one and a half per cent. for leakage. No duty trial has yet been made, but the record book shows

a duty very nearly approaching that guaranteed by the contract, and there is no doubt that upon a trial being made, it will show a duty fully up to the guarantee, if it does not exceed it. The engine is first class in every particular, and its performance during the five months it has been in use, affords ample proof of the wisdom exercised by you in adopting it.

### MAIN PIPES.

During the month of September the twenty-four inch pumping main in Kentucky street hill was lowered about four feet, from the northerly line of Detroit street northerly to Washington street, a distance of about five hundred feet. After the work had been completed and the pipe filled with water again, a leak was discovered about half-way up the hill, which increased in volume so rapidly that a large amount of earth was washed out before the water could be drawn off. When the water was finally drawn out and an examination of the pipe could be made, it was found that a large section of one of the pipes had been broken out, and that the casting was sound only on the surfaces, the interior being honeycombed throughout the whole of the socket, and defective in other parts. This discovery led to an examination of the other pipes on either side of the broken one, and resulted in the removal of one hundred and sixty-eight feet of defective pipe before the repair was complete. This pipe was laid when the Water Works were built, twenty-two years ago, and has been in constant use ever since, without showing any weakness, and might have continued serviceable for years to come, had it not been broken in lowering.

The sixteen-inch distributing main in Girard street, where it crosses the high bluff just west of Scranton avenue, having become uncovered by the gradual washing away of the earth, has been lowered an average of ten feet, for a distance of one hundred feet, or from the base to the top of the bluff.

On the 30th day of October, at one o'clock P. M., the barge Geo. B. Ely was being towed up the river by the tug Triad; the barge was dragging its anchor along the bottom of the river

while passing Superior street, and caught in the twenty-four inch wrought-iron pipe crossing under the river at that point, breaking the shaft of the anchor, which was of wrought iron and six inches in diameter, and tearing a hole in the pipe four by six inches. Before the gates in the broken pipe could be closed, the water in the reservoir had lowered two feet. The pipe has since been taken out of the river, and is now stored on the lot at the pumping works. The two mains crossing under the river at Ohio street, being in good order, but little inconvenience has been experienced in consequence of this pipe being out of service, the only effect being a weakening of pressure on the upper floors of down-town blocks. A few months before this accident happened an extension from the twenty-four inch main at Garden street and Willson avenue was made, through Willson avenue to Superior street, thence westerly through Superior street to Case avenue, there joining another large pipe and forming a circuit with this broken pipe; without this connection the supply of water between Erie street and the river, and north of Ohio street, would have been very weak.

Plans have been prepared and a contract has been made with Miller, Jamieson & Co., of this city, for building a new wrought iron pipe to take the place of the broken one. The new pipe is to be made of half-inch iron, is to be double and square riveted, and is to be three feet in diameter. It will be two hundred and forty-five feet long, measured horizontally between the flanges and the top will be twenty-five feet below the surface of the water in crossing the river. The old pipe was only seventeen feet below the surface of the water.

Provision will be made at each end of this pipe for connecting the old twenty-inch main, and another of thirty inches, the latter to be used at any time in the future when required. It is believed that at a depth of twenty-five feet this pipe will be out of the reach of any harm. The fact that the old one has remained sound and uninjured for twenty-two years, at a depth of only seventeen feet, would seem to be ample assurance of the safety of the new one at the depth proposed. Previous to making the plans for this work, an examination of the ground under the

river and along the margin was made, by sinking bore holes to a depth of seventy feet, with a view to building a tunnel under the river, through which to carry this pipe. Below a depth of fifty feet the clay was of the very best quality, being similar in formation to that under the lake; but an estimate of the cost of the work made the expense appear so much in excess of the cost of sinking a pipe in the bed of the river, that the latter plan was adopted.

### RESERVOIR AND GROUNDS.

The ground in the rear of the reservoir was ploughed in the spring and planted to corn, and during the summer was frequently hoed, thus killing the weeds that had taken such firm foothold in the soil. It is proposed during the coming season to plant another crop, at the same time seeding the ground to grass. By this means it is expected to renew the sod. The work will all be done without expense to the department. The turf and trees in the other portions of the ground are in good condition. The amount of sediment deposited on the inner slopes of the basins since the introduction of water through the tunnel, is so insignificant that the reservoir will only require cleaning out at long intervals; the brick lining at this time is barely colored with the deposit.

### DISTRIBUTING PIPE.

The quantity of distributing pipe laid since our last annual report has been greater than for a number of years, being twelve miles and three thousand four hundred and eight feet, making a total of one hundred and four miles and nineteen hundred and twenty-nine feet of pipe of all sizes. A twelve-inch pipe has been laid in Willson avenue, from Garden street north to Euclid avenue, where it joins the ten-inch pipe running north to Superior street. A ten-inch pipe has also been laid in Superior street, from Willson avenue westerly to Case avenue, and connected with the ten-inch pipe previously laid from the sixteen-inch main in Erie street to Case avenue, thus forming a circuit of

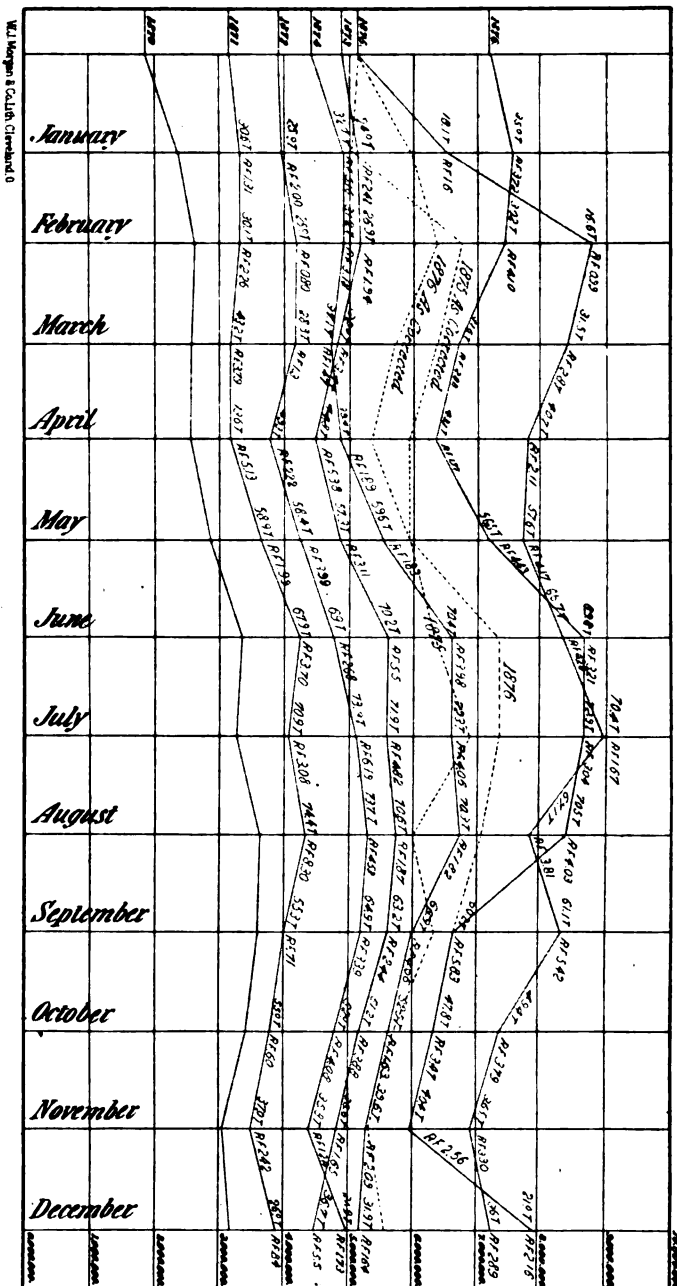
large pipe between the twenty-four inch main in Garden street and the sixteen-inch in Erie street, that will afford a very satisfactory supply of water, in the event of an accident happening to either of the mains, and is at the present time supplying a portion of the city that previously depended for its supply upon the disabled main crossing the river at Superior street. A circuit has also been made in the southwestern portion of the city by the extension of a line of pipe southerly through Burton street to Clark avenue, and easterly through Clark avenue to Columbus street. Pipe has also been laid in Columbus street to the south line of the city. Another pipe has been laid in Scranton avenue, from Clark avenue south to the City Infirmary, thus supplying a long-felt want, and affording protection against fire to that valuable property.

#### SUPPLY OF WATER.

By reference to the last annual report it will be seen that the ratio of increase in consumption of water for 1875 over 1874 is stated at forty and one-tenth per cent., while the increase for 1876 over 1874, a period of two years, is a trifle over seventeen per cent. This difference indicates either a falling off in the consumption of water during 1876, notwithstanding an increase in the number of consumers, or a very serious leakage in the pumps doing the work of 1875. The Cuyahoga engine record makes it appear that that engine pumped over nineteen-twentieths of all the water credited as pumped during that year, and the Cornish engine record shows less than one-twentieth of the total quantity. When the table of quantities and ratios was made, the enormous apparent increase was noticed and the cause suspected; but the quantity of water required each day appeared to be so great, that it was not deemed prudent to stop the Cuyahoga engine long enough to make the examination necessary to ascertain the condition of the pumps; it was therefore continued in service until the new Worthington engine was ready for use when it was taken apart for the purpose of giving it a general overhauling. When the pumps were opened and the valves examined, the cause of the unusual record was made apparent;



# Trustees of Water Works



and while the increase in the use of water may not have been as great in 1876 as in 1875, there is no doubt that a very large proportion of the forty per cent. increase shown in 1875 was due to leakage through the pump valves, as their condition when taken out clearly indicated. In order to show the engine record of the quantity of water pumped each year since 1870, in as intelligible a manner as possible, a diagram is herewith submitted, on which is also shown lines respecting the quantities as corrected for the years of 1875 and 1876, as determined by the record of the Worthington engine for the months of September, October and November, 1876. While the corrections shown are not claimed to be absolutely correct, they are as nearly so as the data at hand will permit them to be, and are given only for the purpose of correcting an erroneous impression that prevails at home and abroad, as to the consumption of water in this city. This diagram also shows the rain fall in inches, and the mean temperature for each month; and the rise and fall of the lines indicate in a very clear and interesting manner the variation in the consumption of water for the different months in the year.

### NEW SUPERSTRUCTURE ON LAKE CRIB.

Plans have been prepared for this new structure in accordance with the recommendation of your Board to the City Council in your last annual report.

The outer wall is to be of massive stone work, bound together in the different courses by continuous bands of iron let into the stone. The four courses nearest the top are to be bound together by forty-five heavy iron bolts, extending from the under side of the band in the eighth course of stone work to the top side of a band of iron extending around the top of the wall. The foundation is to begin at a depth of three and a half feet below the ordinary water line, and will rest upon a bed of concrete that was put in at the time the crib was placed in the lake. There will also be an inner wall of hard brick, resting upon a stone foundation, beginning at the same depth below the water line as the outer wall. Brick arches, having their springing lines upon



cross walls, are to be built between the outer and inner walls. The haunches between these walls are to be filled to a level with the top of the arches, and the whole will then be covered with concrete and finished smooth, to form the main floor of the building, which is to be twelve feet above the water line.

The space below the floor will be divided by the cross walls and piers supporting the floor; and at a height of two and a half feet above the water line, there is to be a rough concrete floor, forming a basement accessible from the main floor.

Comfortable rooms for the crib keeper are to be fitted up in the space between the outer and inner walls, on the south and westerly sides of the building.

The form of the outer wall at its base is such that when ice is moving against the crib it will rise sufficiently to keep it constantly broken up, and thus relieve the building from the enormous pressure brought against it in the winter season by moving fields of ice.

The roof is to be of boiler iron, put together in such a manner as to allow for expansion and contraction. That portion of it extending from the base of the lighthouse tower to the outer wall, is to be fastened down by irons built into the brick arches immediately under the roof, which arches are to be similar to those under the main floor.

The lighthouse tower will rest upon and be fastened to the top of the inner wall, and will be built entirely of iron. The lantern will be fifty feet above the water line, and will contain the Fresnal light now used.

If the work is awarded to an energetic contractor, it may be completed during the present year.

### METERS.

The total number of meters in use December 31st, 1876, was one hundred and sixty-eight. The sizes and number of each size is as follows :

$\frac{3}{4}$ inch.....	47
1 inch.....	56
$1\frac{1}{2}$ inch.....	31
2 inch.....	23
3 inch.....	8
4 inch.....	3
<hr/>	
Total .....	168

There are, in addition to these meters, seventeen hydraulic elevators, to each of which is attached a register for recording the quantity of water used.

### SERVICE PIPES.

The number of service pipe connections made with the distributing pipes during the year, and the different sizes, is as follows :

4 inch. ....	1
3 inch. ....	1
2 inch. ....	1
1 inch. ....	1
$\frac{3}{4}$ inch. ....	34
$\frac{1}{2}$ inch. ....	731
<hr/>	
Total in 1876.....	769

The whole number of service pipe connections made to December 31st, 1876, and the different sizes is as follows:

6 inch .....	1
4 inch .....	23
3 inch.....	26
2 inch.....	49
1½ inch .....	16
1 inch .....	104
¾ inch .....	329
½ inch .....	8,232
<hr/>	
Total of all sizes .....	8,780

Of this number, sixteen hundred and fifty are not in use.

In the following tables will be found the engine record, the consumption of water, the length, size and location of all pipe laid, the stop gates and fire hydrants set.

Respectfully submitted,

JOHN WHITELAW,  
*Superintendent and Engineer.*

CLEVELAND, February 28, 1876.

## REPORT OF THE ENGINEER IN CHARGE OF THE PUMPING WORKS.

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*To the Board of Trustees of Water Works:*

GENTLEMEN—Having been placed in charge of the pumping machinery of the City Water Works, by your Board, February 1st, 1876, the following annual report is most respectfully submitted.

During the first four months following my appointment, we were taxed to the last degree to keep the city supplied with water. The six boilers in the new building, known as the “new Cornish boilers,” I found in a very unsafe condition; and with the history of the old Cornish boilers before me, matters assumed a very serious aspect, but I am gratified at this time to report no lack of water at any time during the past eleven months.

### MACHINERY IMPROVEMENTS.

The improvements made in the pumping works machinery during the past year have been under contemplation for the past two years, and consist of a pair of Worthington Compound Duplex pumping engines, of ten million gallons daily capacity. These have been put in place, and have been able, easily, to supply the city with water at any time since they were started. They are giving good satisfaction in every respect.

A small Worthington Duplex boiler feed pump has been put in for a reserve, in case of accident or repairs to the Cameron feed pump.

### MACHINERY REPAIRS.

The Cameron feed pump has been repaired and removed to a more convenient location near the fire room door, its former location being now occupied by a cistern or reservoir to receive the injection water from the engines.

The portable engine for operating the centrifugal pump has also been put in good serviceable condition.

The Cuyahoga Duplex engines are now undergoing thorough repairs, and will be ready for service early in the spring.

The Cornish engines, with such repairs as have been recommended heretofore, will be in very good condition. These repairs will be made at the earliest possible convenience.

### BOILER IMPROVEMENTS.

The boilers, for which plans and specifications had been prepared when I took charge, were put in place in the south side of the new building during the months of March and April. They are constructed of Otis steel, and are known as tubular boilers, a style which has long stood first among the many different kinds of boilers now in use, and these have fully sustained the reputation which their class so justly merits.

The new Cornish boilers in the south building were in such condition that new ones must be substituted or extensive alterations and repairs had to be made upon them. With your consent plans were made and adopted, and the work of altering commenced, which alterations and repairs have since been completed, and the boilers are now in use and are giving good satisfaction. The grate surface has been increased about fifty per cent., and provision has been made for expansion, a lack of which in their original construction had been the principal cause of their rapid destruction.

The *Ætna* grate bars have been placed in all the boilers in the south building, and are giving such satisfaction as to fully justify their adoption.

The old Cornish boilers are nearly worn out, and new ones should be substituted at the earliest convenience.

### MISCELLANEOUS IMPROVEMENTS.

The Worthington engines are raised about three feet above the engine room floor, that the bottom of the air pump pit may be above the water line of pump wells; this made it necessary to construct a platform around the engines for convenience in operating and adjusting the machinery. The work has been done in a substantial and workmanlike manner.

A cistern has been put in under the engine room floor, with adequate sewer connection to carry off all surplus injection and waste water, from both engines. A reservoir has also been constructed for the boiler feed water. A new steam radiator, with one hundred and twenty-eight pipes has been added to the heating apparatus of the south building. Two new screens have been made for the gate wells, and the old ones have been repaired. All the aqueducts leading from the tunnel to the pump wells have been pumped out and thoroughly cleaned, and the walls of the gate wells have been raised, so as to keep out surface water.

A new calendar clock has been furnished and put up in a suitable case in the south building.

### RECOMMENDATIONS.

Your early attention is called to the necessity of building suitable coal sheds for the better protection of our fuel from the elements, and from thieving, which in spite of our vigilance, is continually going on.

### INCIDENTS, ETC.

February 2d, at one o'clock A. M., the nut which secures the air pump bucket to the plunger connection of the Cuyahoga

duplex engines worked loose, the engines were stopped and the pumps disconnected, and the engines again put in motion until the reservoir could be filled, when they were again shut down and the necessary repairs made.

February 29th, No. 3 boiler, in south building, bagged the crown sheet and put out the fire, the cause was excessive heat and an insufficient number of stay bolts; took it out and put in extra stay bolts.

March 10th, it was found necessary to shut down the south house altogether, as the boilers were all leaking very badly, the Cornish engines were started and the supply was kept up by them until April 3d, when the boiler repairs were completed, and at one o'clock the duplex engines were started, but the unsafe condition of the boilers rendered it dangerous to carry the required pressure of steam to run the engines up to the speed necessary to pump the quantity of water used, one of the Cornish engines was therefore kept running for about eight hours each day, to help keep up the supply, until the new tubular boilers could be completed.

April 12th, the Cuyahoga engines were stopped and the aqueduct pumped out, in order to let the masons put in the foundations for the Worthington duplex engines. Both Cornish engines were then started, and they kept up the supply until April 22d, when the foundations were finished and the new boilers ready for use.

The machinery and boilers in the south house were once more ready for service. These changes, from one house to the other, continued until October 31st, since which time the Worthington engines have run continuously.

July 15th, the thirty inch valve slipped off the south branch of the pumping main, relieving the engines of their load instantly; no damage to the machinery or anything of a serious nature attended this accident, the replacing of the valve was the only work necessary.

July 18th, at twelve o'clock, M., the Worthington duplex engines were ready for service and were immediately started, and have been in a condition to run ever since that time.

September 9th, at ten o'clock, A. M., water was permitted to flow through the continuous tunnel from the crib to the engine houses; water was drawn through the new tunnel by the Worthington engines at twelve o'clock, M., for the first time, since which time all the supply has come through the same source.

September 28th, at half-past six o'clock, P. M., the twenty-four inch pumping main burst, in Kentucky street hill, undermining the thirty-six inch pumping main for about forty feet in length, and rendering it unsafe to continue pumping; the engines were stopped and means immediately employed to secure the pipe, and the engines were started again at three o'clock, A. M., September 29th, after a delay of only eight hours and without interfering in the least with the supply of water to the city.

No statement of duty for either of the engines is made in the annexed tables, for the reason that the running has been very irregular, and the boilers and steam pipes in the south house, that supply the Cuyahoga and Worthington engines, have been undergoing repairs and alterations, and as a consequence have been uncovered nearly the whole season, thus losing by radiation a large amount of heat that is unjustly charged against the engines; the data for computing the duty made for each month is, however, given.

The annexed tables give the quantity of water pumped by each engine, as well as the fuel used by each.

Respectfully submitted,

R. DOTY,

*Engineer in charge of Pumping Works.*

Cleveland, Jan. 1, 1877.



## ENGINE RECORD FOR 1876.

## WORTHINGTON DUPLEX ENGINES.

MONTHS.	DAYS.	PUMPING.		COAL CONSUMED.			GALLONS OF WATER PUMPED.	HEIGHT IN FEET AND DEC.
		HRS. M.	STROKES.	RAISING STEAM.	PUMPING.	TOTAL.		
July.....	14	329 35	189,491	.....	.....	375 800	117,613,274	156 30
August...	8	172 00	97,735	.....	.....	227,600	60,662,159	156.23
September	28	639 20	294,730	.....	.....	623,400	182,933,016	156.37
October...	29	668 10	286,253	3,000	578.70	581,700	176,671,512	156 57
November	30	720 00	292,705	6,000	725.80	731.8 0	181,675,099	156 61
December,	31	744 00	401,612	8,000	950,400	958,400	249 272 536	157.21
Totals and averages.	140	3,273 05	1,562,526	17,000	2,254,900	3,496,700	968,828,596	156.56

## ENGINE RECORD FOR 1876.

## CUYAHOGA DUPLEX ENGINES.

MONTHS.	DAYS.	PUMPING.		COAL CONSUMED.			GALLONS OF WATER PUMPED.	HEIGHT IN FEET AND DEC.
		HRS. M.	STROKES.	RAISING STEAM.	PUMPING.	TOTAL.		
January...	23	524 20	294,540	.....	.....	793,400	126,599,160	156.15
February...	29	671 50	375,942	.....	.....	1,066,200	170,829,253	157.63
March.....	9	216 00	106,052	.....	.....	315,800	28,899,656	157.26
April.....	19	419 50	202,302	.....	.....	635 20	30,814,448	156.32
May.....	31	735 45	402,545	.....	.....	1,105,200	184,559,064	156.34
June.....	30	717 45	421,180	.....	.....	1,127 200	188,809,472	156.43
July.....	18	385 15	238,145	.....	.....	681,600	88,236,454	156.47
August...	20	470 20	304,725	.....	.....	711,400	125,928,433	156.53
Totals and averages.	178	4,141 05	2,347,521	.....	.....	6,396,000	992,675,940	156.89

**CORNISH ENGINE RECORD FOR 1876.**

**EAST ENGINE.**

MONTHS.	DAYS.	PUMPING.		COAL CONSUMED.			GALLONS OF WATER PUMPED.	HEIGHT OF WATER.
		HRS. M.	STROKES.	RAISING STAM.	PUMPING.	TOTAL.		
January ....	14	229 50	101,350	21,000	46,800	68 400	32,561,728	158.077
February ....	5	43 15	27,103	9,800	36,000	45,800	8,707,651	157.609
March .....	24	522 30	237,100	4,000	270,800	274,800	76,175,488	156.548
April .....	16	337 05	129,175	3,000	139,400	142,400	41,501,344	156.166
May .....								
June .....	14	121 10	61,000	9,800	57,100	66 900	19,596,080	156.357
July .....	9	99 35	49,375	7,394	50,600	57,994	15,863,300	156.453
August .....	7	121 20	51,750	3,600	50,800	54,400	16,626,240	156.319
September ..	4	55 30	25,250	1,000	27,200	28,200	8,112,320	156.341
October .....	4	69 10	33,025	3,000	40,600	43,600	10,610,272	156.479
Totals and averages.	97	1,590 25	715 128	63,194	719,300	782,494	229,756,328	156.705

**WEST ENGINE.**

January ....	9	185 35	82,750	11,800	37,300	49,100	26,585,920	157.713
February ....	5	36 15	17,400	22,800	21,800	44,600	5,590,272	157.600
March .....	24	513 50	233,225	5,000	259,200	264,200	74,930,528	156.584
April .....	16	295 50	124,650	3,000	134,600	137,600	40,047,552	156.212
May .....	3	27 30	13,825	2,000	21,000	23,000	4,441,696	156.472
June .....	8	81 5	41,950	5,000	45,400	50,400	13 477,696	156.343
July .....	5	53 50	24,475	6,800	29 400	36,000	7,363,328	156.350
August .....	6	115 25	53,950	3,000	52,200	55,200	17,333,056	156.319
September ..	4	55 50	26,500	3,000	37,400	40,400	8,513,920	156.354
October .....	4	63 20	28,575	3,000	35 200	38,200	9,180,576	156.479
Totals and averages.	84	1,429 15	617,300	65,200	674,100	739,300	207,904,544	156.642

**BOTH ENGINES.**

Totals and averages.	181	3,019 40	1,302,428	128 394	1,393,400	1,521,794	437,720,867	156.662
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## ANNUAL REPORT

*Of Totals and Averages for both Cornish Engines, for each year since the construction of the works.*

YEARS.	PUMPING.		COAL CONSUMED.			GALLONS OF WATER PUMPED.	AV'GE HEIGHT IN FEET & DEC.	DUTY.
	HRS. M.	STROKES.	RAISING STEAM	PUMPING.	TOTAL.			
1857..	1,206 25	399,894	226,200	407,325	633,525	127,232,265	158 000	.....
1858..	1,454 55	446,724	232,050	430,225	662,275	142,135,434	156 533	31,453,235
1859..	1,413 00	623,775	233,050	549,600	782,650	198,234,090	155 927	31,697,233
1860..	1,811 05	818,303	296,750	707,950	766,700	290,220,354	156 466	35,206,906
1861..	2,107 35	1,013,129	265,600	854,150	1,118,750	322,175,022	156 432	37,548,099
1862..	2,347 35	1,162,494	276,846	1,115,127	1,391,178	369,673,092	156 357	34,720,024
1863..	2,590 30	1,310,875	281,903	1,169,418	1,551,321	429,790,875	156 693	35,533,438
1864..	2,848 10	1,483,225	274,744	1,445,568	1,720,392	476,114,225	157 313	34,410,146
1865..	2,971 40	1,611,405	286,950	1,579,559	1,866,500	517,261,005	158 017	34,621,770
1866..	3,321 35	1,829,820	274,800	1,925,400	2,202,200	587,372,220	157 731	35 3 4 567
1867..	3,870 10	2,169,375	200,200	2,162,400	2,432,600	696,369,375	157 439	37,635,498
1868..	4,503 13	2,394,975	198,100	2,078,600	2,078,600	768,786,975	157 822	44,364,421
1869..	5,673 00	2,800,425	70,000	2,585,0 0	2,6 5 0,000	898,936,425	157 509	44,597,444
1870..	6,852 20	3,508,500	49,000	3,388,200	3,437,200	1,126,228,500	156 970	43,010,620
1871..	8,648 35	4,280,500	63,200	4,332,400	4,395,600	1,367,621,100	157 781	41,108,940
1872..	10,562 57	5,253,495	45,200	5,430,800	5,476,000	1,686,370,895	158 377	40,788,146
1873..	12,668 50	5,824,825	13,600	6,122,300	6,135,900	1,869,768,835	157 886	40,081,963
1874..	11,083 05	5,163,325	37,400	5,379,400	5,416,800	1,658,460,090	157 400	40,080,999
1875..	651 07	321,415	148,500	339,585	483,085	103,226,048	158 180	27,775,460
1876..	3,019 40	1,362,428	128,394	1,393,400	1,521,794	437,720,867	156 662	33,120,599

**SCHEDULE**

*Showing the Distribution of Water for each month in the year 1876.*

MONTHS.	Gallons of Water pumped by Cornish Engines.	Gallons of Water pumped by Henderson Duplex Engines.	Gallons of Water pumped by Worthingt'n Duplex Engines.	GALLONS DISTRIBUTED.			
				Per month.	Average per day.	Each inhab't per day.	Each consu'r per day.
January ..	50,147,648	126,509,160	.....	185,746,808	5,991,832	45.02	120.05
February .	14,297,923	170,829,253	.....	185,127,176	6,383,695	47.16	127.90
March.....	151,106,016	26,999,656	.....	178,005,672	5,742,118	43.14	115.04
April.....	81,548,896	90,814,448	.....	162,363,344	5,412,111	40.66	108.43
May.....	4,441,696	184,559,064	.....	189,000,760	6,096,798	45.89	122.15
June.....	33,075,776	188,809,472	.....	221,885,248	7,306,174	55.57	148.19
July.....	23,726,528	88,236,454	117,613,274	229,576,256	7,406,685	55.64	148.38
August ...	33,959,296	125,928,433	60,662,159	220,549,888	7,114,512	53.45	142.54
September	16,626,240	.....	182,933,016	199,559,256	6,651,975	49.96	133.27
October...	19,790,848	.....	176,671,512	196,462,360	6,337,495	47.46	128.97
November	.....	.....	181,676,099	181,676,099	6,055,869	45.50	121.33
December,	.....	.....	249,272,536	249,272,536	8,041,049	60.41	161.11
<b>Totals and averages.</b>	437,720,867	992,675,940	968,828,596	2,399,225,403	6,552,442	49.22	131.28

## SCHEDULE

*Showing the Totals and Averages for each year since the beginning of the works.*

YEARS.	GALLONS DISTRIBUTED.				PER CENT. OF INCREASE.
	PER YEAR.	PER DAY.	EACH INHABITANT PER DAY.	EACH CONSUMER PER DAY.	
1857 .....	127,262,265	348,664	7.75	110.68	.....
1858 .....	142,155,434	398,467	8.87	93.44	11.70
1859 .....	198,244,090	513,107	11.31	91.27	39.45
1860 .....	260,220,354	710,984	14.11	101.57	31.87
1861 .....	322,175,022	881,590	16.32	114.50	23.81
1862 .....	809,673,002	1,012,794	19.47	120.57	14.74
1863 .....	420,790,975	1,152,875	20.97	117.54	12.83
1864 .....	476,114,225	1,300,858	21.68	123.59	12.14
1865 .....	517,261,005	1,417,153	21.80	122.70	8.64
1866 .....	587,972,220	1,609,230	22.35	124.26	13.55
1867 .....	606,369,373	1,907,861	24.85	115.98	18.55
1868 .....	768,786,975	2,106,263	24.77	116.08	10.40
1869 .....	808,936,425	2,462,639	27.36	120.20	16.92
1870 .....	1,126,228,500	3,085,558	30.86	118.20	25.28
1871 .....	1,367,621,100	3,746,907	35.68	124.90	21.43
1872 .....	1,686,370,895	4,607,571	40.07	131.64	22.67
1873 .....	1,800,768,835	5,095,230	43.06	137.71	10.85
1874 .....	2,050,252,910	5,625,150	45.36	141.10	9.65
1875 .....	2,216,775,816	6,073,358	44.00	136.65	8.12
1876 .....	2,369,225,403	6,573,220	49.22	121.28	8.23

## SCHEDULE

Showing Extension of Water Pipe for 1876.

Diameter of pipe in inches.	STREET.	BETWEEN WHAT POINTS.	FEET LAID	TOTAL.	REMARKS.
20	Engine House.....	Connecting Worthington pump engines with main pipes.....	32	32	
24	Kentucky.....	From 70 ft. N. of Vermont, north	168	168	Relaid.
12	Willson avenue.....	N. line of Garden to 24 ft. S. of East Prospect.....	1,864		
12	Willson avenue.....	In Garden, bet. 24 & 8 in. pipes	14	1,878	
10	Clark avenue.....	East line Hickox to west line Columbus.....	1,077		
10	Doan.....	Cross in Euclid avenue to north line Euclid avenue.....	36		
10	Euclid avenue.....	70 feet E. Tilden ave. to 14 feet beyond cross in Fairmount.....	4,275		
10	Fairmount.....	Cross in Euclid ave. to south line Euclid avenue.....	49		
10	Lincoln avenue.....	From S. line Euclid ave. south	6		
10	Superior.....	Valve at east line Case ave. to west line Willson avenue.....	3,108		
10	Willson avenue.....	Cross in Garden to 95 feet north of Scovill avenue.....	1,530	10,081	
8	Bolton avenue.....	Across Euclid avenue.....	83		
8	Broadway.....	196 ft. west of Davies to cross in Petrie.....	3,749		
8	Case avenue.....	T in Mason to 110 ft. S. Payne ave.	980		
8	Cedar avenue.....	T in Willson avenue to East line Willson avenue.....	58		
8	Columbus.....	S. line Clark ave. to city limits	2,688		
8	Czar.....	T in Broadway to S. line B'dway.	46		
8	Doan.....	Cross in Euclid ave. to south line Euclid avenue.....	46		
8	Garden.....	Cross in Willson avenue to east line Willson avenue.....	57		
8	Mason.....	T in Case ave. to east line Case	30		
8	Merwin.....	From valve near Canal to T in West st.....	132		Relaid.
8	Orange.....	Cr's in Perry to cr's in Mayflower	2,269		
8	Payne avenue.....	Cross in Case av. to W. line Case	65		
8	Payne avenue.....	T in Phelps to T in Lawrence..	329		
8	Quincy.....	T in Willson avenue to east line Willson avenue.....	57		
8	St. Clair.....	T in Erie to 21 feet east of west line of Wood.....	1,164		
8	Superior.....	East line Willson avenue to 40 ft. east of Dunham avenue.....	2,018	13,771	
6	Bell avenue.....	T in Euclid avenue to south line Euclid avenue.....	46		
6	Belden.....	T in Superior, north.....	55		
6	Brookfield.....	T in Euclid avenue to north line Euclid avenue.....	36		
6	Bridge.....	W. line Courtl'd to E. line War'y Car.....	700		
6	Cedar avenue.....	N. line Woodland av to T in Platt	768		
6	Clark avenue.....	T in Willson avenue to west line Willson avenue.....	44		
6	Clark avenue.....	East line Columbus to west line Scranton avenue.....	710		
6	Clinton.....	E. line Kentucky to cr's in Duane	538		
6	Canal.....	West line Commercial, east.....	281		{ 4 in. cement- relaid by 6 in. iron.

## SCHEDULE

Showing Extension of Water Pipe in 1876—Continued.

Diameter of pipe in inches.	STREET.	BETWEEN WHAT POINTS	FEET LAID	TOTAL	REMARKS.
6.	Commercial	T in Hill to T in Canal	1,033		
6.	Case avenue	T in Mason to N. line Euclid av.	1,414		
6.	Detroit	Valve in W. River to con. pipe near Tyler alley	558		
6.	Detroit	N. line Center to valve on west line of West River	568		Relaid.
6.	Davies	T in Broadway to N. Broadway	30		
6.	Dille	T in Broadway to N. line B'way	20		
6.	Fairmount	Cross in Euclid avenue to north line Euclid avenue	34		
6.	Fowler	T in Broadway to N. line B'way	20		
6.	Franklin avenue	From end of pipe easterly 200 ft.	206		
6.	Forest	T in B'dway to N. line Trumbull	1,073		
6.	Gallip	T in Broadway, north	28		
6.	Geauga	T in Broadway to N. line B'way	20		
6.	Harkness	T in Euclid av. to N. line Euclid	34		
6.	Hewitt	T in Euclid av. to S. line Euclid	46		
6.	Hanover	T in Old River to E line Old River	31		
6.	Hickory	T in Old River to E line Old River	27		
6.	Irving	South line Woodland ave. to 31 feet south of Orange	601		
6.	Kelley	T in Case av. to E. line Buckeye	942		
6.	Kennard	North line of Garden to 215 feet south of Cedar avenue	1,073		
6.	Lawrence	Cr'ss in Superior to T in Payne av	1,228		
6.	Linden	East line of Garden to cross in Scovill avenue	1,050		
6.	Linden	315 feet south of Scovill, south	171		
6.	Logan, South	T in Euclid, south	1,042		
6.	Logan, North	T in Euclid, north	43		
6.	Martin	T in Broadway to N. line B'way	20		
6.	Merchant avenue	S. line Fairfield to Y in Willey	870		
6.	Merchant avenue	Cross in Willey to cross in Starkweather avenue	394		
6.	Monroe	W. line of Pearl to cross in York	568		
6.	Monroe	T in Mill to T in Penn	668		
6.	Nevada	T in Oregon to cross in Superior	431		
6.	Old River	Cross in Mulberry to cr. in State	1,260		
6.	Oregon	Cross in Perry to T in Nevada	1,000		
6.	Pelton avenue	Cross in Willey to T in Starkweather avenue	834		
6.	Petrie	Cross in B'way to S. line B'way	46		
6.	Phelps	Cr'ss in Superior to T in Payne av	1,266		
6.	Platt	From west line of Car. east	279		
6.	Portland	T in Kennard to T in Will-on av.	139		
6.	Republic	T in Euclid av. to N. line Euclid	34		
6.	Rockwell	T in Erie to east line Wood	1,072		Relaid.
6.	Sawtell avenue	South line of Woodland, south	14		
6.	Scranton avenue	Cross in Clark avenue to 1,212 feet south of Meyer	3,250		
6.	Sibley	From end of pipe near Brooks school, west	75		
6.	Sibley	Cross in Kennard to 378 ft. east of Kennard	404		
6.	Smiths	T in Broadway to N. line B'way	20		
6.	State	From north line Old Riversouth into Division	112		
6.	Sterling avenue	S. line Garden to N. line Scovill	909		
6.	Starkweather ave.	T in Pelton avenue to cross in Jennings avenue	1,063		
6.	University	Cross in Literary to N. line South	2,263		
6.	West River	Between valve and fire hydrant near Myers & Rouse foundry	20		Relaid.

## SCHEDULE

Showing Extension of Water Pipe in 1876—Continued.

Diameter of pipe in inches.	STREET.	BETWEEN WHAT POINTS.	FEET LAID.	TOTAL.	REMARKS.
6.	Williams.....	Cross in Cedar avenue to north line Garden .....	1,080		
6.	West River .....	T in Detroit, south .....	150		} 4 in. pipe relaid by 6 in. pipe.
6.	Willey.....	T in Tremont to cr. in Pelton av T in Forest to 10 feet east of east line of Fore-t.....	146		
6.	Warren .....	W. line of Pearl to E. line State Hydrant and cistern.....	32		
6.	Washington .....		1,086		
			98	35,564	
4.	Arlington.....	T in Cedar ave. to end of pipe..	1,054		
4.	Belmont .....	Cross in Orange to N. line Orange	36		
4.	Bond.....	Cross in Rockwell, north to con. cement pipe .....	125		
4.	Briggs.....	T in Lake to T in Davenport.....	226		
4.	Bond .....	Cross in St. Clair to 106 feet north of north line St. Clair.....	144		
4.	Brainard .....	Cross in Freeman, north .....	121		
4.	Canfield .....	S. line St. Clair to T in Lake.....	616		Relaid.
4.	Cherry.....	Across Perry .....	60		
4.	College.....	Cr. in Professor to T in Freeman	479		
4.	Davenport .....	T in Briggs to west line Briggs.	27		
4.	Fourth.....	T in Commercial to east line of Commercial .....	40		
4.	Fifth.....	T in Commercial to east line of Commercial .....	36		
4.	Freeman .....	Cr. in Brainard, E. to end of pipe	213		
4.	Hayward .....	Cross in Sibley to N. line Sibley	29		} Cement relaid by iron.
4.	Hamilton .....	T in Canfield to W. line Canfield	26		
4.	Kent.....	T in St. Clair to N. line St. Clair	38		
4.	Mulberry .....	Cross in Old River, E. to con. pipe	117		
4.	Oneida.....	T in Kelley to S. line Payne ave.	657		
4.	Rockwell .....	T in W. line Public Square, west	103		
4.	Rositer.....	Cr. in Superior to S. line St. Clair	886		
4.	St. Clair .....	To con. 4 and 8 in. pipes 90 feet west of Bond.....	16		
4.	Third.....	T in Commercial to east line of Commercial .....	36		
4.	Vine.....	S. line Scovill avenue to north line Woodland avenue.....	946		
4.	Washington .....	E. line of Main to Y in Winslow	458		
4.	Winslow .....	From Y in Washington to south line of Mulberry.....	304		
4.	Wood.....	To con. 4 & 8 in pipes in St. Clair For hydrant and cistern con.....	16		
			1,641	8,450	
3.	Miami alley.....	From end of pipe south.....	98		
3.	Hayward .....	North line of Sibley, north.....	291	389	
		Grand total feet laid.....		70,333	



**SCHEDULE**  
*Of Pipe taken up and relaid in 1876.*

Diameter of Pipe taken up.	Diameter of Pipe relaid.	Street.	Between what Points.	No of Feet.	Total.	Remarks.
4 in.	4 in.	Canfield....	S. line St. Clair to T in Lake...	616	.....	Cement.
4 "	6 "	Clinton .....	E. line Kentucky to cross in Duane .....	578	.....	Cement.
6 "	6 "	Detroit .....	W. line Center to valve on W. line W. River .....	568	.....	Cement.
4 "	4 "	Hamilton..	T in Canfield to W. line Canfield .....	26	.....	Cement.
8 "	8 "	Merwin .....	Valve n'r Canal to T in W. River .....	132	.....	Cement.
24 "	24 "	Kentucky ..	70 ft north of Vermont, north .....	166	.....	Cement.
4 "	6 "	Rockwell ..	T in Erie to E. line Wood .....	1,072	.....	Cement.
4 "	6 "	West River ..	T in Detroit, south .....	150	.....	Cement.
6 "	6 "	West River ..	Bet. valve and fire hydrant n'r Myers' Foundry .....	20	.....	Cement.
Total feet relaid .....					3,286	

**TOTAL PIPE LAID TO DECEMBER 31, 1876.**

Diameter of Pipe in inches.	36	30	24	20	16	12	10	8	6	4	3
U'd prev to '76.	1,630	18,009	10,354	10,913	12,514	6,562	57,978	62,492	177,433	117,230	13,956
Laid in '76.....	.....	32	168	.....	.....	1,878	10,081	13,771	36,564	8,450	399
Total.....	1,630	13,071	10,422	10,913	12,514	8,440	68,059	76,263	212,997	125,680	14,345
Tak'n up in '76 .....	.....	.....	168	.....	.....	.....	.....	132	588	2,397	.....
Total in use .....	1,630	13,071	10,354	10,913	12,514	8,440	68,059	76,131	212,409	123,283	14,345
48,382						502,667					

**RECAPITULATION.**

48,382 feet of supply main equal to 9 miles, 862 feet.  
 502,667 feet of distributing main equal to 95 " 1,067 "  
 551,049 104 miles, 1,929 feet.

## SCHEDULE

*Showing Size, Number and Location of Stop Gates Set in 1876.*

Diameter in Inches.	No.	Street.	LINE OF STREET.
30	1	Engine House.	Check on Branch leading to Worthington Engines.
12	1	Willson.....	262 South of Cedar avenue.
12	1	Willson.....	Connect'n valve bet. 24 & 8 in. pipe, Garden
12	1	Willson.....	North line of Garden.
	3	Total.	
10	1	Doan.....	North line of Euclid.
10	1	Euclid .....	East line of Bolton.
10	1	Euclid.....	East line of South Logan.
10	1	Euclid.....	East line of Republic.
10	1	Euclid.....	West line of Fairmount.
10	1	Fairmount.....	South line of Euclid.
10	1	Superior.....	East line of Kirtland.
10	1	Superior.....	East line of North Park street.
10	1	Superior.....	East line of Case avenue.
10	1	Willson.....	South line of Garden.
10	1	Willson.....	North line of Quincy.
	11	Total.	
8	1	Bolton.....	North line of Euclid.
8	1	Bolton.....	South line of Euclid.
8	1	Broadway.....	West line of Forest.
8	1	Broadway.....	West line of Dille.
8	1	Broadway.....	West line of Gallup.
8	1	Broadway.....	West line of Czar.
8	1	Cedar.....	East line of Willson.
8	1	Columbus .....	South line of Holmden.
8	1	Columbus .....	South line of Clark.
8	1	Columbus .....	North line of Sackett.
8	1	Doan.....	South line of Euclid.
8	1	Garden.....	East line of Willson.
8	1	Mason.....	East line of Case avenue.
8	1	Orange.....	East line of Perry.
8	1	Orange.....	West line of Jackson.
8	1	Orange.....	West line of Mayflower.
8	1	Payne.....	West line of Case.
8	1	Quincy.....	East line of Willson.
8	1	St. Clair.....	East line of Bond.
8	1	St. Clair.....	East line of Wood.
8	1	St. Clair.....	West line of Erie.
8	1	Superior.....	East line of Lyon
8	1	Superior.....	East line of Norwood.
	23	Total.	
6	1	Bell.....	South line of Euclid.
6	1	Brookfield.....	North line of Euclid.
6	1	Belden .....	North line of Superior.
6	1	Cedar.....	West line of Willson.
6	1	Case.....	South line of Mason.
6	1	Car.....	North line of Woodland.
6	1	Car.....	South line of Platt.

## SCHEDULE

*Showing Size, Number and Location of Stop Gates Set in 1876.*

Continued.

Diameter in Inches.	No.	Street.	LINE OF STREET.
6	1	Clinton.....	West line of Duane.
6	1	Clinton.....	East line of Duane.
6	1	Commercial...	South line of Hill.
6	1	Commercial...	East line of Canal.
6	1	Davies .....	North line of Broadway.
6	1	Detroit.....	South line of Center.
6	1	Fairmount.....	North line of Euclid.
6	1	Forest.....	North line of Broadway.
6	1	Forest.....	South line of Trumbull.
6	1	Gallup.....	North line of Broadway.
6	1	Harkness.....	North line of Euclid.
6	1	Hewitt.....	South line of Euclid.
6	1	Hickory.....	East line of Old River.
6	1	Hanover .....	East line of Old River.
6	1	Irving.....	South line of Orange.
6	1	Kelley.....	East line of Buckeye.
6	1	Kelley.....	West line of Case.
6	1	Kennard.....	North line of Garden.
6	1	Lawrence.....	South line of Superior.
6	1	Lawrence.....	North line of Payne.
6	1	Linden.....	South line of Garden.
6	1	Linden.....	North line of Scovill.
6	1	Logan N.....	North line of Euclid.
6	1	Logan S.....	South line of Euclid.
6	1	Merchant.....	North line of Starkweather.
6	1	Merchant.....	South line of Willey.
6	1	Merchant. ....	North line of Literary.
6	1	Monroe .....	East line of Penn.
6	1	Nevada.....	North line of Superior.
6	1	Oregon.....	East line of North Perry.
6	1	Oregon.....	West line of Nevada.
6	1	Old River .....	125 feet north of Mulberry.
6	1	Old River .....	West line of Hanover.
6	1	Old River.....	East line of State.
6	1	Pelton.....	South line of Willey.
6	1	Pelton.....	North line of Jefferson.
6	1	Petrie.....	South line of Broadway.
6	1	Phelps .....	South line of Superior.
6	1	Phelps.....	North line of Payne.
6	1	Portland .....	East line of Kennard.
6	1	Portland .....	West line of Willson.
6	1	Platt.....	East line of Car.
6	1	Republic .....	North line of Euclid.
6	1	Rockwell.....	West line of Bond)
6	1	Rockwell.....	East line of Bond
6	1	Rockwell.....	West line of Erie)
6	1	Scranton.....	South line of Clark.
6	1	Scranton.....	South line of Holmden.
6	1	Scranton.....	820 feet south of Meyer.
6	1	Sibley.....	East line of Kennard.

Changed from 4 inch  
to 6 inch valves.

## SCHEDULE

*Showing Size, Number and Location of Stop Gates Set in 1876.*

Continued.

Diameter in Inches.	No.	Street.	LINE OF STREET.
6	1	Starkweather..	West line of Pelton.
6	1	Starkweather..	East line of Jennings.
6	1	Streator .....	South line of Euclid.
6	1	University .....	South line of Literary.
6	1	University .....	North line of Jefferson.
6	1	University .....	North line of South street.
6	1	Washington....	West line of Pearl.
6	1	Washington....	East line of Hanover.
6	1	Washington....	West line of Hanover.
6	1	Washington....	East line of State.
6	1	Warren .....	East line of Forest.
6	1	Williams.....	South line of Cedar.
6	1	Williams.....	North line of Garden.
6	1	West River....	East line of Detroit... (Changed from 4 in to 6 in. valve.
6	1	York .....	North line of Monroe.
6	7	For Hydrant &	Cistern connections.
	79	Total.	
4	1	Arlington.....	South line of Cedar.
4	1	Bond.....	North line of Rockwell.
4	1	Bond.....	North line of St. Clair.
4	1	Briggs .....	North line of Lake.
4	1	College.....	West line of Professor.
4	1	College.....	West line of University.
4	1	College.....	East line of Tremont.
4	1	Freeman .....	East line of Brainard.
4	1	Fourth.....	East line of Commercial.
4	1	Fifth.....	East line of Commercial.
4	1	Hayward.....	North line of Sibley.
4	1	Mulberry .....	50 feet west of first hydrant west of Pearl
4	1	Oneida.....	North line of Kelly.
4	1	Oneida.....	South line of Payne.
4	1	Rockwell.....	West line of Public Square.
4	1	Rossiter .....	North line of Superior.
4	1	Rossiter .....	South line of St. Clair.
4	1	Wood .....	In St. Clair, to connect 4 and 8 inch pipes
4	1	St. Clair.....	90 ft. west Bond. " " " "
4	1	Vine.....	South line of Scovill.
4	1	Winslow .....	North line of Washington.
4	129	For Fire Hy-	drants and Cisterns.
	150	Total.	

## SCHEDULE

*Showing Size, Number and Location of Stop Gates Set in 1876.  
Concluded.*

## RECAPITULATION.

Total Number of Stop Gates Set in Streets to December 31st, 1876.

Water way in inches.....	36	30	24	20	16	12	10	8	6	4	3	Total.
Set previous to 1876.....	1	12	7	12	19	12	80	109	387	623	266	1528
Set in 1876.....						3	10	23	79	150		266
Total.....	1	12	7	12	19	15	90	132	466	773	266	1794
Taken out in '76										6	6	12
Total in use	1	12	7	12	19	15	90	132	466	767	260	1782

## SCHEDULE

Showing Fire Hydrants set in 1876.

Size in Inches.	STREET.	Feet.	LOCATION.	SIDE.
4.....	Arlington court...	271	South of Cedar.....	East.
3.....	Arlington.....	588	South of Cedar.....	East.
4.....	Arlington.....	1054	South of Cedar.....	East.
4.....	Bond.....	73	North of Rockwell.....	East.
4.....	Broadway.....	47	West of Forest.....	North.
4.....	Broadway.....	114	West of Geauga.....	North.
4.....	Broadway.....	134	West of Dille.....	North.
4.....	Broadway.....	155	West of Martin.....	North.
4.....	Broadway.....	310	East of Gallup.....	North.
4.....	Broadway.....	50	West of Fowler.....	North.
4.....	Broadway.....	.....	At Smith.....	North.
4.....	Broadway.....	.....	At Petrie.....	North.
4.....	Brainard.....	.....	At Freeman.....	East.
4.....	Bridge.....	.....	At Scott.....	South.
4.....	Car.....	390	North of Woodland.....	West.
4.....	Case avenue.....	330	North of Euclid.....	East.
4.....	Case avenue.....	684	North of Euclid.....	East.
4.....	Case avenue.....	1049	North of Euclid.....	East.
4.....	Case avenue.....	368	North of Kelley.....	East.
4.....	Clark avenue.....	149	West of Brighton.....	South.
4.....	Clark avenue.....	66	East of Mill.....	North.
4.....	Clark avenue.....	.....	At Johnson.....	South.
4.....	Columbus.....	58	South of Kinkel.....	West.
4.....	Columbus.....	350	North of Holmden.....	West.
4.....	Columbus.....	.....	At Holmden.....	West.
4.....	Columbus.....	.....	At Meyer.....	West.
4.....	Columbus.....	303	South of Meyer.....	West.
4.....	Columbus.....	.....	At Sackett.....	West.
4.....	Columbus.....	.....	At City Limits.....	West.
4.....	College.....	101	East of Tremont.....	North.
4.....	Commercial.....	.....	At Canal.....	West.
C. 3 to 4	Detroit.....	188	South of Center.....	East.
4.....	Detroit.....	203	South of West River.....	East.
4.....	Euclid avenue.....	86	West of Brookfield.....	North.
4.....	Euclid avenue.....	133	West of Bolton.....	North.
4.....	Euclid avenue.....	155	East of Bolton.....	North.
4.....	Euclid avenue.....	78	East of Harkness.....	North.
4.....	Euclid avenue.....	136	East of Hewett.....	North.
4.....	Euclid avenue.....	.....	At Republic.....	North.
4.....	Euclid avenue.....	53	West of Doan.....	North.
4.....	Euclid avenue.....	250	East of Doan.....	North.
4.....	Euclid avenue.....	238	East of Tilden.....	North.
6.....	Euclid avenue.....	.....	At Fairmount.....	North.
4.....	Franklin.....	410	East of Russia.....	South.
4.....	Fourth.....	.....	At Commercial.....	North.
C. 4 to 3	Hamilton.....	346	West of Ross.....	South.
C. 3 to 4	Hamilton.....	.....	At Canfield.....	North.
4.....	Irving.....	.....	At Orange.....	East.
4.....	Irving.....	192	North of Broadway.....	East.
4.....	Kelley.....	.....	At Case.....	South.
4.....	Forest.....	.....	At Trumbull.....	East.

## SCHEDULE

Showing Fire Hydrants set in 1876.—Continued.

Size in Inches.	STREET.	Feet.	LOCATION.	SIDE.
4.....	Kelley .....	96	West of Oneida .....	South.
4.....	Kelley .....	8	East of Buckeye .....	South.
4.....	Kennard .....	421	North of Garden .....	East.
4.....	Kennard .....	880	North of Garden .....	East.
4.....	Lawrence .....	25	South of Superior .....	East.
4.....	Lawrence .....	389	South of Superior .....	East.
3.....	Lawrence .....	347	North of Payne .....	East.
4.....	Lawrence .....	...	At Payne .....	East.
4.....	Linden .....	319	South of Garden .....	East.
4.....	Linden .....	261	North of Scovill .....	East.
4.....	Logan .....	...	At Euclid .....	West.
4.....	Logan .....	990	South of Euclid .....	West.
4.....	Logan .....	189	South of Euclid .....	West.
4.....	Logan .....	578	South of Euclid .....	West.
4.....	Mason .....	...	At Case .....	South.
4.....	Merchant avenue .....	351	South of Willey .....	West.
4.....	Merchant avenue .....	451	South of Fairfield .....	West.
C 3 to 4	Merwin .....	...	Near British .....	West.
4.....	Monroe .....	41	East of McLane .....	North.
4.....	Monroe .....	72	West of Jersey .....	North.
4.....	Nevada .....	...	At Oregon .....	East.
4.....	Old River .....	15	South of Hickory .....	East.
4.....	Old River .....	40	South of Hanover .....	East.
4.....	Old River .....	25	North of State .....	East.
4.....	Oneida .....	216	North of Kelley .....	East.
4.....	Oneida .....	...	At Payne .....	East.
4.....	Orange .....	460	East of Perry .....	South.
4.....	Oregon .....	342	East of Perry .....	South.
4.....	Oregon .....	233	West of Nevada .....	South.
4.....	Pelton avenue .....	...	At Willey .....	West.
4.....	Pelton avenue .....	375	South of Willey .....	West.
4.....	Phelps .....	305	South of Superior .....	East.
4.....	Phelps .....	716	South of Superior .....	East.
4.....	Phelps .....	13	North of Payne .....	East.
4.....	Payne avenue .....	...	At Case .....	North.
4.....	Portland .....	248	East of Kennard .....	South.
4.....	Portland .....	377	West of Willson .....	South.
4.....	Platt .....	60	East of C. & P. R. R. ....	North.
C 3 to 4	Rockwell .....	176	East of Wood .....	South.
C 3 to 4	Rockwell .....	234	West of Erie .....	North.
4.....	Rossiter .....	...	At Sonora .....	East.
4.....	Scranton avenue .....	25	North of Kinkel .....	East.
4.....	Scranton avenue .....	15	South of Holmden .....	East.
4.....	Scranton avenue .....	16	South of Meyer .....	East.
4.....	Scranton avenue .....	28	North of Wright .....	East.
4.....	Scranton avenue .....	419	South of Meyer .....	East.
4.....	Scranton avenue .....	819	South of Meyer .....	East.
4.....	Scranton avenue .....	1212	South of Meyer .....	East.
4.....	Sibley .....	402	West of Hayward .....	North.
6.....	St. Clair .....	209	East of Bond .....	North.
C 3 to 6	St. Clair .....	90	West of Bond .....	North.

## SCHEDULE

Showing Fire Hydrants set in 1876.—Concluded.

Size in Inches.	STREET.	Feet.	LOCATION.	SIDE.
6.....	St. Clair .....		At Wood.....	North.
4.....	Sterling avenue... 150		North of Scovill.....	East.
4.....	Sterling avenue... 359		South of Garden.....	East.
4.....	Streator avenue... ..		At Euclid... ..	West.
4.....	Starkweather ave. ....		At Pelton.....	North.
4.....	Starkweather ave. ....		At Merchant.....	North.
4.....	Superior .....		At Lyman.....	North.
4.....	Superior .....		At North Park .....	North.
4.....	Superior .....		At Hoadley .....	North.
4.....	Superior .....		At Kirtland .....	North.
4.....	Superior .....		At Sherbrook.....	South.
4.....	Superior .....	53	East of Rockford .....	South.
4.....	Superior .....	441	West of Norwood.....	South.
4.....	Superior .....		At Norwood.....	North.
4.....	Superior .....	40	East of Dunham.....	South.
4.....	University .....	26	North of Jefferson.....	West.
4.....	University .....	318	South of Jefferson.....	West.
4.....	University .....	717	South of Jefferson.....	West.
4.....	University .....		At Starkweather.....	West.
4.....	Vine.....	107	North of Woodland.....	East.
4.....	Vine.....	405	North of Woodland.....	East.
4.....	Vine.....	126	South of Scovill.....	East.
4.....	Washington .....	458	East of Pearl .....	South.
4.....	Washington.....	214	West of Hanover.....	South.
4.....	Washington.....		At State.....	South.
4.....	Winslow .....		At Mulberry .....	West.
4.....	Willson avenue... 47		North of Cedar .....	West.
4.....	Willson avenue... 253		South of Cedar .....	West.
4.....	Willson avenue... 628		South of Cedar .....	West.
4.....	Willson avenue .. 459		North of Garden .....	West.
4.....	Willson avenue... 79		North of Garden .....	West.
4.....	Willson avenue... 310		South of Garden .....	West.
4.....	Willson avenue... 229		North of Quincy.....	West.
4.....	Willson avenue... 89		South of Quincy.....	West.
4.....	Willson avenue... 49		North of Garden.....	East.
4.....	Williams street .. 388		South of Cedar.....	East.
138....	Total .....			
7....	Changed in 1876..			
131....	In use, set in 1876. ....			
652....	Total set to 1876..			
788....	In use Dec. 31, 1876 ..			



**FIRE HYDRANTS CHANGED.**

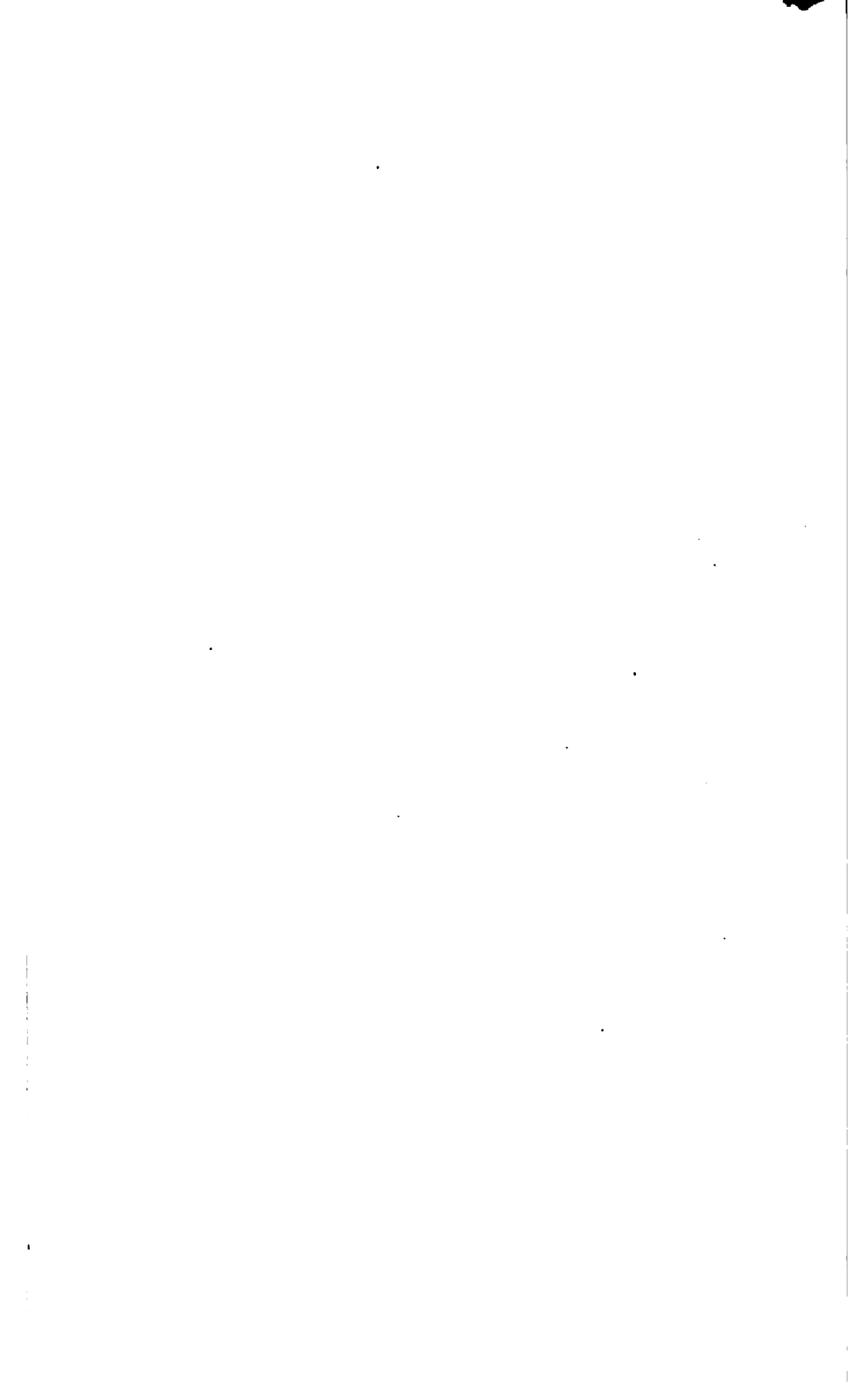
Changed		STREET.	Feet.	LOCATION.	Side.
From	To				
3	4	Detroit.....	188	South of Center.....	East.
4	3	Hamilton.....	346	West of Ross.....	South.
3	4	Hamilton.....		At Canfield .....	North.
3	4	Merwin .....		Near British.....	West.
3	4	Rockwell.....	176	East of Wood.....	South.
3	4	Rockwell.....	234	West of Erie.....	North.
3	6	St. Clair .....	90	West of Bond ...	North.

7    Total number of hydrants changed.

**FIRE CISTERNS CONNECTED.**

Size of Con.	No.	STREET.	LOCATION.
4	1	Case avenue....	At Woodland.
6	1	Davies.....	At Broadway.
6	1	Gallup .....	At Broadway.
4	1	Superior. ....	At Belden.
6	1	Warren.....	At Forest.
	5	Total.	





14 E. Price C. 6

TWENTY-SECOND  
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OF THE  
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OF

TRUSTEES OF WATER WORKS

TO THE

CITY COUNCIL.

OF CLEVELAND,

TOGETHER WITH THE

Reports of the Officers of the Board,

FOR THE YEAR 1877.

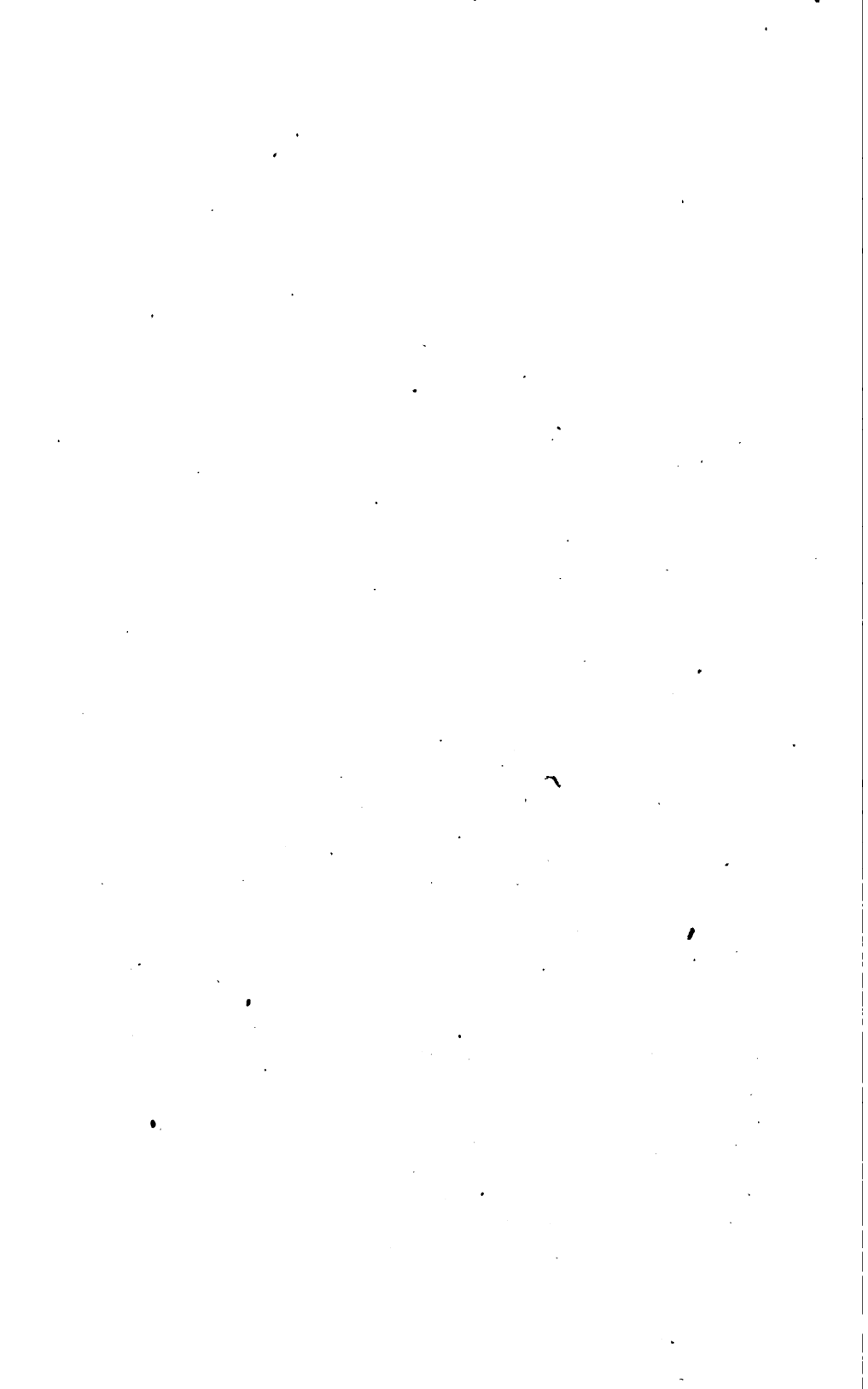
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1878.

DUPLICATE EXCHANGE ? AUG. 1901

.M. SOC. CIVIL ENGINEERS



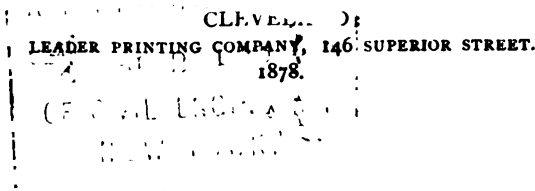
TWENTY-SECOND  
ANNUAL REPORT  
OF THE  
BOARD  
OF  
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~~REPORTS~~ of the Officers of the Board,

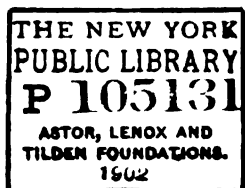
Compliments of

1877.

JOHN WHITELAW,

*Superintendent and Engineer.*





## REPORT OF TRUSTEES OF WATER WORKS.

---

*To the Honorable Mayor and City Council of Cleveland :*

The undersigned, Trustees of the Water Works, herewith submit the Reports of the Superintendent and Engineer and Secretary for the year 1877, which so fully show the operations of the department, that any suggestions from us seems unnecessary. The condition of the Works appear to be such that by judicious and systematic management they will in a few years be self-sustaining.

For further and detailed information as to the management and condition of the department, you are respectfully referred to the accompanying reports.

PATRICK SMITH,  
TRUMAN DUNHAM,

*Trustees of the Water Works.*

CLEVELAND, February 18th, 1878.





## SECRETARY'S REPORT.

---

*To the Board of Trustees of Water Works:*

GENTLEMEN—In accordance with the regulations of this Department, I respectfully submit the following Financial Report.

The receipts and disbursements for the year 1877, including cash balances, are as follows:

### RECEIPTS.

For Water, including permits, viz:			
From assessments.....	\$106,349 68		
From measurement.....	46,614 55		
		\$152,964 23	
Less amount refunded.....		169 55	
			\$152,794 68
On Pipe Extension Account.....			615 90
On Construction Account.....			18 55
On Repairs Account.....			601 05
Cash in City Treasury and Water Works Office, January 1st, 1877.....			48,709 47
Total.....			\$202,739 65

## DISBURSEMENTS.

On Pipe Extension Account.....	\$35,108 07		
On Construction Account....	13,932 47		
On Lake Crib Superstructure Account.....	33,435 76		
On Interest Account.....	107 50		
For Water Meters.....	2,697 64		
For Office and General Expenses.....	26,166 27		
For Engine House Expenses .....	24,405 19		
For General Repairs.....	18,512 93		
For Repairs at Engine House .....	2,961 48		
		\$147,177 81	
Cash balance in City Treasury, Jan. 1st, 1878.....		55,396 22	
Cash balance in Water Works Office Jan. 1, 1878.....		286 12	
Total.....			\$302,739 65

The receipts for Water for the year are in excess of the previous year the sum of eleven thousand six hundred and forty dollars and eight cents, being about the average increase for several years past.

The expenditures under the heads of the various ledger accounts, after deducting credits, are:

On Pipe Extension Account.....	\$34,492 17
On Construction Account .....	13,913 93
On Lake Crib Superstructure Account.....	33,435 76
For Office and General Expenses.....	26,166 27
For Engine House Expenses.....	24,405 19
For General Repairs.....	17,711 88
For Repairs at Engine House .....	2,961 48
For Water Meters.....	2,697 64
For Interest.....	107 50
Total.....	\$145,941 81

## BOARD OF TRUSTEES OF WATER WORKS.

7

I estimate that the Receipts for Water for the year 1878 will amount to.....	\$160,000 00	.....
To which add Cash Balance in City Treasury.....	55,326 22	.....
Total.....		\$215,326 22
And that the disbursements will be—		
For Operating Expenses and ordinary Repairs.....	60,000 00	.....
For final Payments on existing Contracts.....	33,000 00	.....
For Appropriation for Interest.....	35,000 00	.....
For new Boilers for Cornish Engines.....	20,000 00	.....
For Cash necessary to be on hand January 1st, 1879.....	20,000 00	.....
Total.....		\$168,000 00
Leaving a balance for other purposes of .....		\$47 326 22

This estimate for expenses and repairs is less than the amount expended in 1877; but, as nearly eight thousand dollars of the cost of repair in that year was for material and labor for the main pipe and connections at the crossing of the River at Superior street, and over two thousand dollars for repairing the dock at the Engine House lot, also at least twenty-five hundred dollars for other extraordinary items of expense, it seems probable that the estimate is sufficiently large.

It may be observed that a large proportion of the expenses at the River Crossing was really for betterments, and might with propriety have been carried to Construction instead of Repairs Account. However, as there is a constant deterioration in the material of the pipe system and other parts of the work, it seems proper, as has been the practice, to charge Expense and Repair Accounts with many expenditures that are actually betterments. Should these estimates prove essentially correct, and the expenditure for boilers be made, a balance of over forty-seven thousand dollars will be available for extending the pipe system—a sum sufficient to lay a large

amount of distributing pipe at its present price, and all that public necessity requires.

LEDGER BALANCES JANUARY 1, 1878.

	DR.	CR.
Construction .....	\$2,358,154 15	
Lake Crib Superstructure .....	33,875 76	
Water Meters .....	10,394 52	
Bills Receivable .....	4,375 06	
Cash .....	236 12	
City Treasurer .....	55,326 22	
Bonds .....		\$1,735,000 00
Water Rent (Income) .....		664,117 35
City of Cleveland .....		48,473 60
Interest and Discount .....		4,700 65
Total .....	\$2,462,291 80	\$2,462,291 80

In the forgoing statement of Ledger balances, the account Water Meters is intended to represent the actual value of the Meters, and not their cost.

It is believed that the average duration of Meters will not exceed ten or twelve years; all expense therefore of their fittings and for setting the same, as well as freight and repairs, together with a proper portion of the purchase cost thereof, are charged to Expense or Repair Accounts.

The account City of Cleveland represents money furnished by the City Council and Board of Education to lay Water Pipe as desired by them.

The accounts Construction, Lake Crib Superstructure and Meters, amounting to \$2,402,354.43, may with propriety be regarded as the present value of the Water Works property.

## STATEMENT OF THE TOTAL COST OF THE WATER WORKS PROPERTY.

Reservoir Grounds and Embankment.....	\$84,853 43
Engine House Grounds and Improvements.....	54,350 45
Engine Houses, including Foundations.....	194,062 99
Engines and Boilers.....	221,630 15
Lake Tunnel and Crib.....	399,976 12
Pipe System.....	1,378,321 00
Aqueduct.....	56,829 77
Meters.....	10,324 52
<b>Total.....</b>	<b>\$2,402,354 43</b>

In preparing the above statement, some difficulty was found in positively classifying some of the items of expenditures, but it is believed to be mainly correct.

## BONDED DEBT.

The bonded debt of the City for Water Works purposes has not been increased during the year.

The present amount of this debt is as follows:

Six per cent. Bonds due July 1st, 1878.....	\$25,000 00
Seven per cent. Bonds due January 1st, 1879.....	400,000 00
Six per cent. Bonds due July 1st, 1879.....	25,000 00
Seven per cent. Bonds due October 1st, 1880.....	75,000 00
Seven per cent. Bonds due January 1st, 1881.....	100,000 00
Seven per cent. Bonds due January 1st, 1884.....	300,000 00
Seven per cent. Bonds due May 1st, 1892.....	400,000 00
Seven per cent. Bonds due May 1st, 1893.....	200,000 00
Six per cent. Bonds due October 1st, 1895.....	200,000 00
<b>Total.....</b>	<b>\$1,725,000 00</b>

The Sinking Fund of the City is pledged for the payment of the principal of nine hundred and twenty-five thousand dollars of these bonds, (being the first six amounts above specified,) funds for which are already provided. The entire interest of the debt has heretofore been paid by a tax levied on the real and personal taxable property of the City.

It is understood, however, that this department will pay of interest the sum of thirty-five thousand dollars in 1878.

As a matter of reference, I have prepared the following statement, showing the amount of interest that will be payable annually on the Water Works Bonds until the time of their maturity.

1878 .....	\$118,250 00	1887 .....	\$54,000 00
1879 .....	102,750 00	1888 .....	54,000 00
1880 .....	87,250 00	1889 .....	54,000 00
1881 .....	78,500 00	1890 .....	54,000 00
1882 .....	75,000 00	1891 .....	54,000 00
1883 .....	75,000 00	1892 .....	40,000 00
1884 .....	64,500 00	1893 .....	19,000 00
1885 .....	54,000 00	1894 .....	12,000 00
1886 .....	54,000 00	1895 .....	12,000 00

I may be permitted to say that it gives me pleasure to state that the time seems to have nearly arrived when no tax levy to pay interest on the Water Bonds will be required beyond such an amount as may be deemed just in order to relieve the water-takers from the entire burden of supporting the department.

This view is sustained by the probability that no extraordinary expenditures for the enlargement of the Works will be required for several years to come, and that the ordinary operating expenses and repairs will be but little increased over my estimate for 1878, while, on the other hand, a constant

increase in the receipts for water may be confidently expected.

The receipts for water for several years past are as follows:

1870.....	\$70,411 18	1874.....	\$116,433 08
1871.....	80,487 44	1875 (ten months) .....	114,730 28
1872.....	90,243 96	1876.....	141,152 60
1873.....	108,481 00	1877.....	152,794 68

The average rate of increase, it will be seen, is over eleven thousand dollars per annum; and it appears evident that should the rate of increase be even much less the department will soon be in a very satisfactory condition, especially when it is considered that the bonded debt will be reduced from time to time, so that in 1884 the amount outstanding will be eight hundred thousand dollars.

H. C. HAWKINS,

*Secretary.*

CLEVELAND, January 1st, 1878.



# REPORT

OF THE

## SUPERINTENDENT AND ENGINEER.

---

*To the Board of Trustees of Water Works:*

GENTLEMEN—The Annual Report of the Superintendent and Engineer of Water Works for the year ending December 31st, 1877, is herewith respectfully submitted.

### LAKE CRIB.

The work of building the new stone superstructure on the lake crib was commenced early in May; but, owing to delay in receiving the cut stone in the early part of the season, has only been completed to the top of the tenth course of masonry, leaving two courses yet to be laid before the roof can be put on. Work was discontinued about the first of November, not on account of the lack of materials or unfavorable weather at the time, but for the reason that any further prosecution of the work would have necessitated the removal of the old roof, and thus expose the completed masonry to the action of the elements, at a season of the year the most unfavorable for such work, and too late to hope that the new roof could be put on before winter set in. The inner timbers of the old structure had to be removed as the masonry advanced, leaving only the outer shell as a shelter for the workmen and the completed walls: the outer timber walls have been braced in a secure manner to resist the storms and floating ice during the winter.

The first work to be done when work is resumed in the spring will be the removal of the old roof.

## TUNNEL.

The tunnel has continued to fulfill the purpose for which it was built without interruption. While the foundation for the new superstructure on the crib was being laid, the inlet gates through the crib were closed. This was done for the purpose of lowering the water level inside of that structure as much as possible. The leakage through the timber proved sufficient to supply the pumps at the rate of twelve million gallons in twenty-four hours, while the water inside of the crib stood from twenty-four to twenty-eight inches lower than in the lake. The surplus water pumped while this work was being done, amounting to forty-eight and a half million gallons, was wasted through the waste-pipe from the reservoir to the old river bed.

The quality of the water furnished for the year has, with the exception of a few days in March, been equal to that supplied in former years. During the month of March a heavy freshet occurred in the river while the lake was covered with ice, and for a few days the water drawn through the tunnel was slightly impregnated with the taste of petroleum. This is the first and only time since the completion of the tunnel that water from the river has ever reached the crib.

## ENGINE HOUSE AND GROUNDS.

No repairs have been required or made to either of the engine houses.

The lot upon which the south building stands, that has heretofore presented such an unsightly appearance, has been graded and turfed, and cindered walks and drive-ways have been laid out. The streams of water coming from the springs on the bank south of the lot have been brought together, by means of open drains lined with brick, to a large basin, also lined with brick, in which are deposited the sand brought down with the water. The water is carried thence by an

open drain of similar construction to a second basin, in the center of which is a fountain. From this basin the water passes into an under-ground sewer and is discharged into the river.

A substantial picket fence has been built along the easterly, southerly and westerly sides of the lot, while on both sides of the roadway, passing between the buildings, a strong and neat wrought-iron fence five feet high has been built, and eight cast-iron hitching posts have been set in the roadway for the accommodation of visitors to the works.

The old coal dock has been entirely rebuilt, and a new dock extended from its easterly end to the easterly line of the lot, affording for the present ample dock room for handling coal.

Your attention is again called to the request of the Engineer in charge of the pumping works, to have suitable coal sheds erected for the protection of the coal.

A railway track has been laid from the coal dock to the boiler rooms of both engine houses, and also along the coal dock. Two wrought-iron coal cars, large enough to carry a ton of coal each, have been made for moving coal and ashes, and afford a means for the easy and rapid movement of coal from the dock, and ashes from the furnaces.

#### MACHINERY AND BOILERS.

For information regarding the condition of the different pumping engines and boilers, you are respectfully referred to the accompanying report of the Engineer in charge of the Pumping Works. His statement as to the condition of the old Cornish boilers is a reiteration of the recommendations contained in his last Annual Report, and invites your early attention and prompt action.

#### PUMPING MAINS.

Neither of the pumping mains have required any repairs during the year; the only leak in any of their connections being in a lead joint in the thirty-six-inch valve.

## RESERVOIR AND GROUNDS.

The brick lining of the reservoir for a few feet above and below the water line has been repaired where necessary. In several places the clay lining under the brick had slipped, leaving a depression in the slope above the water line and a projection below; in all such places the paving and clay were removed to the proper depth and refilled with new clay. The slopes were also cleaned of the growth of aquatic plants and the slight accumulation of sediment to a depth of ten feet. During the spring the water should be drawn off, and both basins should be cleansed. The grass on the outer slopes was never in a better condition than during the past year. The ground south of the embankment was cultivated as during the preceding year, and will be seeded with grass the coming spring.

A new fence should be built along the easterly line of the lot from Franklin Street to the rear of the adjoining lot; this should be done to prevent cattle from entering the reservoir grounds through other property.

## SUPPLY MAINS.

There has been but one leak in either of the cast-iron supply mains during the year, and that was caused by the slipping of the lead in a joint, and was repaired in a few minutes by driving the lead back into the joint. There have been several very annoying leaks in the sixteen-inch wrought-iron cement-line main, the cost of repairing which would amount to more than the outlay for repairs to the cast-iron mains for the last three years, if we except the cost of repairing the river pipe at the foot of Superior Street. The laying of a cast-iron pipe to take the place of this cement-lined pipe is recommended whenever any permanent improvements are made in the streets through which it is laid.

The thirty-six inch boiler iron pipe, made to take the place of the one injured in October, 1876, was successfully laid on the fifth day of April. The depth at which it is laid is nearly a foot greater than was originally intended, the top being twenty-six feet below the ordinary stage of water in the river, and below any probable danger from accidents similar to the one that destroyed the twenty-four inch pipe.

#### DISTRIBUTING PIPES.

The quantity of distributing pipe laid during the year is unusually small as compared with preceding years, notwithstanding the fact that pipe could be purchased at a lower price than at any time since the works were built. The general depression in business, and the fact that a large quantity of pipe was laid in advance of the necessities of the districts, other than as providing protection against fire, during the years 1875 and 1876, under an appropriation of the City Council, operated to reduce the number of petitions to have pipe laid. The total length of all sizes laid during the year was three miles and 3,051 feet, besides 1,741 feet of pipe relaid.

The total length of pipe of all sizes laid to December 31st, 1877, is 107 miles and 5,007 feet.

#### WATER METERS.

The total number of water meters in use at the end of the year was two hundred and forty-eight; the number added during the year was eighty. The number of each size is as follows:

$\frac{3}{4}$ Inch.....	91	2 Inch.....	33
1 Inch.....	82	3 Inch.....	10
$1\frac{1}{4}$ Inch.....	29	4 Inch.....	3
Total.....			248

There are also in use eighteen hydraulic elevators, each one having attached to it an instrument that registers the quantity of water used. Two have been added during the year.

## SERVICE PIPES.

During the year, six hundred and fifty-nine service connections have been made with the distributing pipes, as follows:

4 Inch.....	3	1½ Inch.....	2
3 Inch.....	4	¾ Inch.....	24
2 Inch.....	8	½ Inch.....	617
1½ Inch.....	1		
		Total, of all sizes.....	659

The whole number of service pipe connections made to December 31st, 1877, and the different sizes, is as follows:

6 Inch.....	1	1½ Inch.....	2
4 Inch.....	26	1 Inch.....	104
3 Inch.....	80	¾ Inch.....	353
2 Inch.....	57	½ Inch.....	8,849
1½ Inch.....	17		
		Total, of all sizes.....	9,439

Of this number, sixteen hundred and seventy-nine are not in use. In explanation of the reason why so large a number of service pipes are not in use, it may be stated that nearly all of them are laid in paved streets, in front of unimproved property. For a number of years past, the City has caused such pipes to be laid in advance of pavement, so as to avoid the tearing up of streets where the property to be supplied with water was improved.

## GENERAL.

As the rates charged for water for domestic and manufacturing purposes is a matter in which every citizen is interested, and especially such of our citizens as are by the nature of their business obliged to use large quantities of water, it will not be out of place here to refer to a Report made by D. Farrand Henry, Chief Engineer of the Detroit Water Works, to a special committee of the Detroit Common Council. Mr. Henry, after speaking of the difficulties in the way of making accurate comparisons between different cities, on account of the absence of uniformity in the manner of making the assessments, says: "I have however, as an example, calculated the assessment of a first-class house, having all the water fixtures by the rates lately received from a dozen different cities, as shown in the table given below. Of these cities, ten are much higher than Detroit, while only Hartford and *Cleveland* are lower."

It will be seen by the table to which he refers, and which is here given, that the water rates are lower in Cleveland than in any of the other cities named.

"The following is the table referred to as showing the price of water per year for a family of five persons in a first-class dwelling in the cities named:

Hartford.....	\$23 00	Chicago.....	\$34 00
Philadelphia .....	27 75	Milwaukee .....	34 50
Brooklyn.....	29 25	Toledo.....	28 25
Albany.....	31 00	Louisville .....	31 50
Buffalo.....	43 50	Pittsburgh.....	71 59
Cleveland.....	21 50	Detroit.....	23 50
Cincinnati.....	33 80		

“The following table shows the prices charged per one hundred gallons in the cities named:

CITIES.	PRICE, CTS.	CITIES.	PRICE, CTS.
Charlestown, Mass.....	2 to 3	Cleveland.....	1 to 1 $\frac{3}{4}$
Salem.....	2 to 3	Cincinnati.....	1 $\frac{1}{2}$
Concord.....	1 $\frac{1}{2}$ to 2 $\frac{1}{2}$	Bay City.....	1 $\frac{1}{2}$ to 4
Providence.....	3	Chicago.....	1
Hartford.....	1 to 3	Evansville.....	1 $\frac{1}{2}$ to 2
Philadelphia.....	1 $\frac{1}{2}$	Indianapolis.....	2 to 4
Albany.....	1 to 4	Milwaukee.....	2
Brooklyn.....	2	Memphis.....	1 $\frac{1}{2}$ to 2
Jersey City.....	1 $\frac{1}{4}$ to 1 $\frac{1}{2}$	Kansas City.....	2 to 5 $\frac{1}{2}$
Oswego.....	1 to 4	Toledo.....	1 $\frac{1}{2}$ to 2
Syracuse.....	1 to 4	Columbus.....	2
Rochester.....	2 to 4	Louisville.....	1 $\frac{1}{2}$ to 3 $\frac{1}{2}$
Buffalo.....	2 to 3	Detroit.....	2

By a recent revision of our meter rates, such consumers as use large quantities of water obtain it at a rate considerably below the lowest rate given in the above table—one firm having used such a quantity that the rate amounted to only eight mills per hundred gallons for the six months ending in October, and several others obtained it at rates varying between eight and ten cents per thousand gallons. It will be thus seen that the citizens of Cleveland obtain their water, not only for domestic use, but also for manufacturing purposes, at rates as low, if not lower than is charged in any other city using steam as a motive power for its pumping machinery.

Cleveland can well afford to furnish water at low rates, for, of thirteen of the larger cities of the country, the cost of pumping water in this city is the lowest. Last year the average cost of pumping one million gallons one foot high was only  $\$0.008$  cents; and during four months of the year, while



the work was all being done by the Worthington engines, the cost was less than five cents per million gallons.

With a pipe system embracing one hundred and eight miles of the different sizes of pipe, and pumping machinery capable of elevating to the reservoir twenty-eight million gallons of water in twenty-four hours, while the present maximum consumption does not reach ten million gallons in the same length of time, the Cleveland Water Works are prepared to furnish water to nearly double the present number of consumers, and still have a portion of the machinery in reserve in case of accident. This excess in the amount of pumping power is a substitute for an elevated storage reservoir; and the system, while costing less than the reservoir system would with us, has the advantage of supplying water to the patrons of the works directly from the great natural reservoir, Lake Erie. Water that enters the tunnel at any hour is being distributed to consumers within six hours from the time it enters. In this manner, as pure water as can be obtained from Lake Erie is furnished to our citizens.

Respectfully submitted.

JOHN WHITELAW,

*Superintendent and Engineer.*

CLEVELAND, February 28th, 1878.

# REPORT

OF THE

## ENGINEER OF PUMPING WORKS.

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*To the Board of Trustees of Cleveland Water Works:*

GENTLEMEN—In presenting my Second Annual Report, I am enabled to say that nothing of a serious character has occurred to interfere with our daily pumping during the year 1877.

### GENERAL REPAIRS.

*Cuyahoga Engine.*—The repairs upon the Cuyahoga Engine, which were in progress at the close of 1876, have been completed, and the engine was started March 1st, since which time it has been held in reserve, and only run at short intervals during the year to keep it in working order.

On the 24th of July a fracture was discovered in the east end of the lower chamber of the south pump. Subsequent examination developed the fact that the chamber had cracked from the opening or pump end to the opening for inserting valves on each side of the pump. Immediate steps were taken to secure it which have proved perfectly successful. This engine is now in good condition.

*Worthington Engine.*—No repairs have been necessary upon this engine, and no expense has been incurred other than the necessary attendance, excepting in making the usual examination in regard to the wearing of the bearings and pistons, and substituting weights for springs upon the main pump

valves. This engine is now in perfect order, and can be depended upon for steady, satisfactory work.

*East Cornish Engine.*—The main stop valve, which has been on hand for some years, was put in place during the months of June and July, between the main pump and stand pipe, and supplies a much-needed improvement.

*West Cornish Engine.*—The West Cornish piston has been put in order, and the cylinder head repaired. At this time the main pump is receiving a new lower-valve chamber, the old chamber having been fractured for many years. With this work finished, this engine and pump will be in perfect working order.

The cost of these repairs has been as follows:

Cuyahoga Engine.....	\$3,355 65
Worthington Engine.....	107 18
East Cornish Engine.....	271 07
West Cornish Engine.....	256 13
<b>Total.....</b>	<b>\$3,990 03</b>

#### RECOMMENDATIONS.

The repairs upon the West Cornish cylinder-head were occasioned by the destructive nature of the lubricant used in these cylinders for many years. The same repairs are also necessary upon the East engine cylinder-head, and from the same cause. I would, therefore, recommend that it be done at once, as delay will only render it more difficult of accomplishment. With this work completed, the Cornish engines and pumps will be in good condition for much more good service.

Pardon me for once more referring to the Coal Sheds, so much needed to complete the improvements so wisely commenced in 1877. They should be built at your earliest convenience.

As I have referred, under the head of Boilers, to the condition of the old Cornish boilers in the north building, I have only to add here that new boilers should be provided with the least possible delay, that the whole Water Works machinery may be made available to meet all possible emergencies, as any accident to the thirty-six inch pumping main would make the City dependent upon these engines for the supply of water.

It has been apparent for many years that the Cornish pumps did not get water enough at low stages of water in Lake Erie to insure safety. At first it was supposed the pump suction might be lengthened to accommodate this want, but recent investigations show that the wells must be deepened before this can be done. Your earliest attention is called to this matter as one of importance and worthy of your consideration.

#### IMPROVEMENTS.

The improvements made around the pumping works the past year, in the way of fencing, laying out and improving the grounds (putting down an iron floor in the boiler room, and railway tracks around the grounds,) and the building of a new coal dock, have long been needed, and are highly appreciated by all immediately connected with the Pumping Works, and while adding greatly to the appearance of the grounds, they also add to the convenience and economy of doing our work, and insure greater protection from petty thefts, which have been a source of constant loss for years past.

A stationary Thermometer for testing the temperature of the feed water supplied to the boilers and a Pyrometer to indicate at what temperature the gases escape from the boiler flue to the chimney, have been kindly furnished to afford us better means of controlling these elements, which enter so largely into the economical management of steam power.

## BOILERS.

The boilers in the south building consist of two tubular and six Cornish, all in good condition, no expense having been necessary since my last report, excepting the necessary care to keep them in running order.

The boilers in the north building have been faithful servants for over twenty-two years, and are no longer reliable for steady work. Having developed serious defects incident to their age during the past year, they should have an honorable discharge, as the time has come when we must depend largely upon the Cornish engines at certain seasons of the year.

The annexed tables will show the amount of water pumped and coal consumed.

Respectfully submitted,

R. DOTY,

*Engineer in Charge of Pumping Works.*

## ENGINE HOUSE RECORD FOR 1877, OF THE WORTHINGTON DUPLEX ENGINES.

MONTHS.	DAYS.	PUMPING.		COAL CONSUMED.			GALLONS OF WATER PUMPED.	HEIGHT IN FEET AND DEC.
		HOURS, MIN.	STROKES.	RAISING STEAM.	PUMPING.	TOTAL.		
January.....	31	743 10	435,650	3,000	998,000	998,000	364,192,442	157,464
February.....	28	623 10	303,580	2,000	738,300	738,300	188,432,343	157,579
March.....	30	394 40	187,213	2,000	420,149	422,149	116,199,384	157,862
April.....	15	348 00	149,786	2,800	310,230	312,830	92,688,141	157,311
May.....	31	744 00	381,861	2,800	796,800	799,600	294,569,866	157,755
June.....	30	720 00	374,143	.....	776,400	776,400	282,222,459	158,155
July.....	30	447 45	242,668	2,800	570,839	573,639	150,619,176	158,283
August.....	31	744 00	436,925	2,400	996,000	998,400	364,968,309	158,696
September.....	30	717 15	387,492	4,000	862,000	866,000	340,509,334	157,395
October.....	24	558 00	288,773	800	698,538	694,388	179,285,686	157,308
November.....	17	380 00	171,216	.....	372,639	372,639	106,270,348	157,534
December.....	26	576 30	258,546	2,800	555,900	556,400	160,474,232	157,376
Totals and Averages.....	302	6,995 31	3,577,302	25,200	7,963,385	8,004,535	2,230,676,360	158,370

## ENGINE HOUSE RECORD FOR 1877, OF THE CUYAHOGA DUPLEX ENGINES.

MONTHS.	DAYS.	PUMPING.		COAL CONSUMED.			GALLONS OF WATER PUMPED.	HEIGHT IN FEET AND DEC.
		HOURS. MIN.	STROKES.	RAISING STEAM.	PUMPING.	TOTAL.		
March.....	20	344 20	216,647	3,000	684,656	687,656	131,213,996	157,871
April.....	16	372 00	306,222	.....	555,772	555,772	115,891,309	157,495
July.....	13	296 15	301,635	.....	585,961	585,961	112,914,792	158,970
October.....	9	190 00	135,623	800	313,062	313,862	69,642,410	157,798
November.....	15	340 00	307,543	2,800	562,271	565,071	113,594,510	157,648
December.....	8	167 10	101,713	.....	244,000	244,000	55,670,577	157,625
Totals and Averages.....	81	1,709 45	1,069,393	6,600	2,825,794	2,832,394	598,317,484	157,869

## CORNISH ENGINE RECORD FOR 1877—EAST ENGINE.

MONTHS.	DAYS.	PUMPING.		COAL CONSUMED.			GALLONS OF WATER PUMPED.	HEIGHT OF WATER.
		HOURS. MIN.	STROKES.	RAISING STEAM.	PUMPING.	TOTAL.		
January.....				13,400		13,400		
February.....	8	37 30	18,275	12,000	20,000	32,000	5,866,275	157,553
July.....	9	84 45	42,150	15,200	46,000	61,200	13,530,150	158,918
August.....	14	43 25	67,650	16,800	66,600	83,400	21,731,945	158,611
September.....	5	34 55	13,625	6,000	14,000	20,000	4,377,713	157,316
Totals and Averages.....	31	298 45	141,700	63,400	146,600	210,000	45,510,063	158,069



## CORNISH ENGINE RECORD FOR 1877—WEST ENGINE.

MONTHS.	DAYS.	PUMPING.		COAL CONSUMED.			GALLONS OF WATER PUMPED.	HEIGHT OF WATER.
		HOURS. MIN.	STROKES.	RAISING STEAM.	PUMPING.	TOTAL.		
January.....				15,300	.....	15,300	.....	.....
February.....	8	38 55	19,250	8,400	24,900	92,600	6,179,350	197,553
June.....	3	17 00	7,550	6,000	17,300	93,300	2,425,060	190,055
July.....	8	106 00	54,675	11,800	56,400	66,300	17,550,675	190,354
August.....	10	140 00	79,150	13,600	74,000	87,600	25,431,865	190,516
November.....	4	30 15	13,310	3,600	16,300	19,800	4,376,508	167,303
Totals and Averages.....	26	332 10	173,935	56,600	188,000	246,600	55,062,383	196,197

## BOTH ENGINES.

East Engine.....	31	298 45	141,700	63,400	146,600	210,000	45,510,083	188,099
West Engine.....	28	332 10	173,935	58,600	188,000	246,600	55,962,383	196,597
Totals and Averages.....	59	630 55	315,635	122,000	334,600	456,600	101,372,466	192,318

ANNUAL REPORT OF TOTALS AND AVERAGES FOR BOTH CORNISH ENGINES FOR EACH YEAR SINCE  
THE CONSTRUCTION OF THE WORKS.

YEARS.	PUMPING.		COAL CONSUMED.			GALLONS OF WATER PUMPED.	AVERAGE HEIGHT IN FEET AND DEC.	DUTY.
	HOURS. MIN.	STROKES.	RAISING STEAM.	PUMPING.	TOTAL.			
1857 .....	1,306 25	399,894	228,300	407,325	635,525	127,362,365	158.000	...
1858 .....	1,454 55	446,724	252,050	430,225	682,275	142,155,434	156.533	31,435,325
1859 .....	1,413 00	623,775	253,050	549,600	792,650	198,234,060	155.927	35,697,332
1860 .....	1,811 05	818,303	298,750	707,950	766,700	260,220,354	156.466	35,306,908
1861 .....	2,107 35	1,013,129	365,600	854,150	1,118,750	322,175,022	156.432	37,548,069
1862 .....	2,247 35	1,162,404	276,846	1,115,127	1,391,178	369,673,092	156.357	34,730,024
1863 .....	2,590 30	1,310,875	281,908	1,169,418	1,551,321	430,790,875	156.693	35,585,438
1864 .....	2,848 10	1,483,225	274,744	1,445,568	1,720,392	476,114,225	157.313	36,410,146
1865 .....	2,971 40	1,611,405	298,950	1,579,559	1,866,500	547,361,005	158.017	36,621,770
1866 .....	3,321 35	1,829,890	276,800	1,995,400	2,302,300	597,372,220	157.731	35,304,537
1867 .....	3,670 10	2,160,375	300,300	2,162,400	2,433,600	696,399,375	157.439	37,685,498
1868 .....	4,503 13	2,394,975	198,100	2,078,600	2,276,700	798,798,975	157.822	44,364,421
1869 .....	5,673 00	2,800,425	70,000	2,595,000	2,655,000	898,936,425	157.509	44,597,444

## ANNUAL REPORT OF TOTALS AND AVERAGES FOR BOTH CORNISH ENGINES—CONTINUED.

YEARS.	PUMPING.		COAL CONSUMED.			AVERAGE HEIGHT IN FEET AND DEC.	DUTY.
	HOURS. MIN.	STROKES.	RAISING STEAM.	PUMPING.	TOTAL.		
1870 .....	6,852 20	3,508,500	49,000	3,398,300	3,437,300	156.970	43,010,680
1871 .....	8,648 35	4,360,500	63,900	4,332,400	4,395,600	157.791	41,103,940
1872 .....	10,563 57	5,253,495	45,900	5,430,800	5,476,000	158.377	40,788,146
1873 .....	12,868 50	5,894,835	13,600	6,132,300	6,135,900	157.686	40,031,968
1874 .....	11,068 05	5,163,335	37,400	5,379,400	5,416,800	157.400	40,060,999
1875 .....	651 07	331,415	143,500	839,135	433,085	158.180	27,775,400
1876 .....	3,019 40	1,362,438	123,394	1,393,400	1,521,794	156.662	38,120,509
1877 .....	630 55	315,635	122,000	334,000	456,000	158.318	27,925,97

SCHEDULE SHOWING THE DISTRIBUTION OF WATER FOR EACH MONTH IN THE YEAR 1877.

MONTH.	GALLONS OF WATER PUMPED BY CORLISS ENGINES.	GALLONS OF WATER PUMPED BY DUPLEX HENDERSON ENGINES.	GALLONS OF WATER PUMPED BY DUPLEX WORTHINGTON ENGINES.	WATER WASTED.	GALLONS DISTRIBUTED.		
					PER MONTH.	AVERAGE PER DAY.	EACH INHABITANT PER DAY.
January.....	.....	.....	264,192,442	.....	264,192,442	8,806,411	63.81
February.....	12,045,525	.....	198,432,943	.....	200,477,798	7,159,980	51.88
March.....	.....	121,213,986	116,199,364	.....	237,413,360	7,658,485	55.49
April.....	.....	115,881,309	92,988,141	.....	208,319,350	6,943,978	50.31
May.....	.....	.....	224,599,886	.....	224,599,886	7,245,157	52.50
June.....	2,425,060	.....	222,222,459	.....	224,647,519	7,321,588	56.67
July.....	31,080,825	107,174,043	150,619,176	24,272,640	264,601,404	8,535,529	61.85
August.....	47,166,840	.....	264,983,909	24,272,640	287,878,009	9,286,387	67.29
September.....	4,377,713	.....	240,508,534	.....	244,886,247	8,162,874	59.15
October.....	.....	61,494,349	179,235,626	.....	240,729,975	7,765,479	56.27
November.....	4,376,508	94,861,416	106,270,348	.....	205,398,267	6,846,608	49.61
December.....	.....	46,707,615	160,474,232	.....	207,181,947	6,683,268	48.42
Totals & Averages..	101,372,466	546,922,528	2,220,678,360	48,545,280	2,880,326,074	7,726,920	55.91
							142.24

The increase in the ratio of the consumption of water over the year 1876, as shown in these tables, is due in part to a leak that was discovered in the pipe crossing the river at Upper Central Way Bridge, and partly to the large quantity of water—nearly one million gallons a week—used by one new consumer. The quantity in the column under the head of "Wasted Water" is not included in the estimate of water distributed.

## SCHEDULE SHOWING THE TOTALS AND AVERAGES

*For each Year since the Beginning of the Works.*

YEARS.	GALLONS DISTRIBUTED.				PER CT. OF IN- CREASE.
	PER YEAR.	PER DAY.	EACH INHABITANT PER DAY.	EACH CONSUMER PER DAY.	
1867.....	127,262,265	348,064	7.75	110.08	.....
1868.....	142,155,434	396,467	8.37	93.44	11.70
1869.....	198,264,090	513,107	11.31	91.27	39.45
1860.....	260,220,354	710,984	14.11	101.57	31.87
1861.....	322,175,022	861,599	16.32	114.50	23.81
1862.....	369,673,092	1,012,794	19.47	120.57	14.74
1863.....	420,790,875	1,152,875	20.97	117.54	12.63
1864.....	476,114,225	1,300,858	21.68	123.89	12.14
1865.....	517,261,005	1,417,153	21.80	122.70	8.64
1866.....	587,372,220	1,609,239	22.35	124.26	13.55
1867.....	696,269,375	1,907,861	23.85	115.98	18.55
1868.....	768,786,975	2,106,265	24.77	116.08	10.40
1869.....	898,936,425	2,462,839	27.36	120.20	16.92
1870.....	1,126,228,500	3,065,558	30.86	113.20	25.28
1871.....	1,367,621,100	3,746,907	35.68	124.90	21.43
1872.....	1,686,370,895	4,607,571	40.07	131.64	22.67
1873.....	1,869,768,835	5,095,220	43.06	137.71	10.86
1874.....	2,060,252,910	5,625,150	45.36	141.10	9.65
1875.....	2,216,775,816	6,073,358	44.00	136.65	8.12
1876.....	2,399,225,403	6,573,220	49.22	131.26	8.23
1877.....	2,820,326,074	7,726,920	55.91	142.24	17.55

## SCHEDULE SHOWING EXTENSION OF WATER PIPE IN 1877.

SIZE.	STREET.	BETWEEN WHAT POINTS.	FEET LAID.	TOTAL.	REMARKS.
36...	Superior.....	Wrought iron under the River .....	274	.....	Relaid.
36...	Superior.....	From River dock line east. ....	63	.....	Relaid.
36...	Superior.....	End of wrought-iron pipe south.....	33	.....	Relaid.
				370	.....
30...	West River.....	30" valve west .....	8	.....	
				8	.....
20...	Superior.....	20" valve east to connect old pipe at C. C. C. & I. R. R. ....	163	.....	Relaid.
20...	West River.....	Near west line West River, south.....	60	.....	Relaid.
				223	.....
10...	Doan.....	North line Euclid, north.....	10	.....	
10...	Fairmount.....	South line Euclid, south .....	9	.....	
				19	.....
8...	Garden.....	East line of Willson, east.....	6	.....	
8...	Payne.....	Tee in Payne at Wason, west.....	85	.....	
8...	Payne.....	Tee in Aaron to Tee in Phelps.....	343	.....	
8...	Payne.....	Valve on W. L. Siegel to Tee Lawrence.....	556	.....	
8...	Quincy.....	East line Willson to 18' east of Ashland.....	1,815	.....	
8...	St. Clair.....	21 ft. east of west line Wood to 43 west of east line of Water .....	2,255	.....	
8...	Waverly.....	West line Lorain, north.....	178	.....	
8...	East River.....	20" cross in Superior to N. L. Superior.....	137	.....	Relaid.
8...	Merwin.....	20" cross in Superior to S. L. Superior.....	60	.....	Relaid.
				5,435	.....
6...	Aaron.....	South line St. Clair to cross in Superior.....	962	.....	
6...	Aaron.....	Cross in Superior to Tee in Payne.....	1,304	.....	
6...	Birch.....	South line Franklin, south.....	8	.....	
6...	Curtiss.....	Tee in Olive, east.....	349	.....	
6...	Danforth.....	Tee in Superior to cross in Payne.....	1,184	.....	
6...	Dayton.....	Tee in Kelly, north .....	48	.....	
6...	Delaware.....	S. line St. Clair to cross in Superior .....	817	.....	
6...	Doan.....	Cross in Franklin, south.....	65	.....	

## EXTENSION OF WATER PIPE—CONTINUED.

SIZE.	STREET.	BETWEEN WHAT POINTS.	FEET LAID.	TOTAL.	REMARKS.
6...	East Prospect.	East line Willson, east.....	8		
6...	Giddings.....	Reservoir Tee, north.....	12		
6...	Hough.....	Tee in Willson, east.....	66		
6...	Lexington.....	Cross in Willson, east.....	62		
6...	Madison.....	North line of Euclid to S. L. of Hough.....	1,032		
6...	Marion.....	East line of Perry, east.....	287		
6...	Minnesota.....	Tee in St. Clair to Tee in Superior.....	761		
6...	Sibley.....	Hydrant W. of Hayward to E. L. Sago.....	339		
6...	Siegel.....	Tee in Superior to Tee in Payne.....	1,147		
6...	Sterling.....	North line of Garden, north.....	9		
6...	Sixth.....	Tee in Willson, east.....	63		
6...	Walnut.....	Cross in Muirson to Tee in Dodge.....	1,559		
6...	Wasson.....	Tee in Superior to Tee in Payne.....	1,337		
6...	West River.....	E line of Center to hydrant at Myers Foundry.....	870		Relaid.
6...	Windsor.....	Cross in Case to east line Case.....	36		
6...		For hydrant and cistern connections.....	75		
				12,390	
4...	Hicks.....	North line Lorain, north.....	280		
4...	Perkins.....	East line Willson, east.....	29		
4...	Pleasant.....	From 29' south of Clark, south.....	657		
4...	State.....	N. line Detroit to cross in Washington.....	444		
4...	Ward.....	South line Lorain, south.....	16		
4...	West.....	Tee in Merwin, east.....	37		Relaid.
4...		For hydrant connections.....	372		
				1,815	
8...	Williams Alley	South line Lake, south.....	328		
	Williams Alley	Tee in St. Clair to north line St. Clair...	44		
				372	
		Total feet laid.....		20,632	

SCHEDULE SHOWING WATER PIPE TAKEN UP AND RE-LAID IN 1877.

DIAMETER OF PIPE TAKEN UP.	DIAMETER OF PIPE RE-LAID.	STREET.	BETWEEN WHAT POINTS.	FEET LAID.	TOTAL REMARKS.
24 inch.	36 inch.	Superior	Wrought iron under River.	274	
20 inch.	36 inch.	Superior	From River dock line, east.	63	
20 inch.	36 inch.	West River	End of wrought-iron pipe, south.	33	
20 inch.	20 inch.	Superior	20' valve east to connect old pipe on hill.	163	
20 inch.	20 inch.	West River	Near west line of West River, south.	60	
4 inch.	8 inch.	East River	20' cross in Superior to north line Superior.	137	
6 inch.	6 inch.	West River	East line Center to hydrant at Meyer's Foundry.	870	
4 inch.	4 inch.	West	Tee in Merwin, east.	37	
2 inch.	3 inch.	Williams Alley	Tee in St. Clair to north line St. Clair.	44	
8 inch.	8 inch.	Merwin	20' cross in Superior to south line Superior.	60	
				1,741	



## TOTAL PIPE LAID TO DECEMBER 31, 1877.

Diameter of Pipe in inches	36	30	24	20	16	12	10	8	6	4	3
Laid previous to 1877	1,630	13,071	10,254	10,913	12,514	8,440	68,059	76,131	212,409	123,363	14,345
Laid in 1877	370	8		223			19	5,435	12,300	1,815	372
Total	2,000	13,079	10,254	11,136	12,514	8,440	68,078	81,566	224,709	125,098	14,717
Taken up in 1877			274	292				60	870	174	44
Total in use	2,000	13,079	9,980	10,844	12,514	8,440	68,078	81,506	223,939	124,924	14,673
	48,417 feet.										821,550 feet.

## RECAPITULATION.

48,417 feet of Supply Main—equal to	9 miles, 997 feet.
531,550 feet of Distributing Main—equal to	98 miles, 4,110 feet.
589,967 feet—equal to	107 miles, 5,007 feet.

SCHEDULE SHOWING SIZE, NUMBER AND LOCATION OF  
STOP GATES SET IN 1877.

DIAMETER IN INCHES.	No.	STREET.	LINE OF STREET.
30	1	Superior .....	49' ft. west of W. line of Merwin.
30	1	West River.....	9½ ft. E. of W. line of West River.
	2	Total.....	
20	1	Superior .....	50 ft. W. of W. line Merwin.
20	1	West River.....	3¼ ft. S. of W. line of West River.
	2	Total.....	
8	1	Quincy .....	East line of Willson.
8	1	Quincy .....	East line of Lodge.
8	1	St. Clair.....	East line of Ontario.
8	1	St. Clair.....	West line of Ontario.
8	1	St. Clair.....	Connection valve between 8" and 4" pipes in Ontario.
8	1	St. Clair.....	East line of Seneca.
8	1	St. Clair.....	Connection valve between 8" and 4" pipes in Seneca.
8	1	St. Clair.....	East line of Bank.
8	1	St. Clair.....	West line of Bank.
8	1	St. Clair.....	East line of Water.
8	1	Seneca .....	North line of St. Clair.
8	1	Superior.....	Connection valve between 20" and 4" is 7' east of west line River.
	12	Total.....	
6	1	Aaron .....	North line of Superior.
6	1	Aaron .....	South line of Superior.
6	1	Aaron .....	North line of Payne.
6	1	Birch.....	South line of Franklin.
6	1	Danforth.....	South line of Superior.
6	1	Danforth.....	North line of Payne.
6	1	Delaware.....	North line of Superior.

SIZE, NUMBER AND LOCATION OF STOP GATES SET IN 1877—  
Continued.

DIAMETER IN INCHES.	No.	STREET.	LINE OF STREET.
6	1	Dayton .....	North line of Kelley.
6	1	Hough .....	East line of Willson.
6	1	Lexington .....	East line of Willson.
6	1	Minnesota .....	North line of Superior.
6	1	Madison .....	North line of Euclid.
6	1	Siegel .....	South line of Superior.
6	1	Siegel .....	North line of Payne.
6	1	Sixth .....	East line of Willson.
6	1	Wasson .....	South line of Superior.
6	1	Wasson .....	North line of Payne.
6	1	Walnut .....	West line of Dodge.
6	1	Walnut .....	East line of Muirson.
6	1	Walnut .....	At second hydrant E. of Muirson.
6	1	Windsor .....	East line of Case.
6	6	For hydrant and cistern connections.	
	27	Total .....	
4	1	Court .....	South line of St. Clair.
4	1	Perkins .....	East line of Case.
4	31	For hydrant connections .....	
	33	Total .....	

## RECAPITULATION.

*Total Number of Stop Gates Set in Streets to December 31st, 1877.*

Water way in inches.....	36	30	24	20	16	12	10	8	6	4	3	2	TOTAL.
Set previous to 1877.....	1	12	7	12	19	15	90	132	466	767	260	.....	1,782
Set in 1877.....	.....	2	.....	2	.....	.....	.....	12	27	33	.....	.....	76
Total.....	1	14	7	4	19	15	90	144	493	800	260	.....	1,858
Taken out in 1877.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	.....	2
Total in use.....	1	14	7	14	19	15	90	144	493	799	259	.....	1,856

## SCHEDULE SHOWING FIRE HYDRANTS SET IN 1876.

SIZE IN INCHES.	STREET.	FEET.	LOCATION.	SIDE.
4	Aaron		South line of St. Clair	East
4	Aaron	372	South of St. Clair	East
4	Aaron	181	North of Superior	East
4	Aaron	14	South of Superior	East
4	Aaron	791	North of Payne	East
4	Aaron	388	North of Payne	East
4	Aaron		At Payne	East
4	Curtiss	329	East of Olive	South
4	Danforth	318	South of Superior	East
4	Danforth	354	North of Payne	East
4	Delaware	356	South of St. Clair	East
4	Madison	710	North of Euclid	East
4	Madison		South line of Home	East
4	Minnesota	163	South of St. Clair	East
4	Minnesota	221	North of Superior	East
4	Payne		At Danforth	South
4	Pleasant	488	South of Clark Avenue	East
4	Quincy	11	West of Jasper	South
4	Quincy		At First Avenue	South
4	Quincy	20	East of Slater	South
4	Quincy		At Richland	South
4	Quincy		At Ashland	South
4	Siegel	7	North of Payne	East
4	Siegel	445	North of Payne	East
4	Siegel	301	South of Superior	East
6	St. Clair	279	East of Water	North
6	St. Clair		At Seneca	North
6	St. Clair		At Williams Alley	North
6	St. Clair		At Court Place	North
4	Walnut	258	East of Muirson	South
4	Walnut	1167	West of Dodge	South

## FIRE HYDRANTS SET IN 1876—Continued.

SIZE IN INCHES.	STREET.	FEET.	LOCATION.	SIDE.
4.....	Walnut .....	367	West of Dodge.....	North.
4.....	Wasson .....	408	North of Payne.....	East.
4.....	Wasson .....	404	South of Superior .....	East.
4.....	West River .....	24	North of South line of Elm, changed from 3" to 4".....	East.
35.....	Total .....			
1.....	Changed in 1877.....			
34.....	In use, set in 1877.....			
753. ....	Total set to 1877.....			
817.....	Total in use Dec. 31, '77.....			

## FIRE CISTERNS CONNECTED.

6".....	Payne.....	At Wasson.....
6".....	Madison .....	At Euclid.....

## ABSTRACT OF EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877.

BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	GENERAL EXPENSES.	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CRIB SU- PERSTRUC- TURE.	WATER METERS.	CONSTRUC- TION.	TOTAL.
Jan. Pay Rolls.....			\$ 349 30	\$ 1,613 70	\$ 1,299 50	\$ 169 98				\$ 3,414 82
Short & Forman .....	Stationery			771 90						71 60
Nevins' Printing House.....	Receipts.....			90 00						90 00
C. H. Clark .....	Coal.....			15 40						15 40
Marchand & Son.....	Gas Fixtures			10 68						10 68
Cleveland Gas Light Co.....	Gas Bills.....			7 53						7 53
People's Gas Light Co.....	Gas Bill.....				74 55					74 55
V. Swain's Sons.....	Rope.....				8 92					8 92
A. T. Van Tassel & Co.....	Hardware.....				4 47					4 47
Globe Iron Works.....	Wrought Iron Pipe.....				2 61					2 61
Edwards, Townsend & Co.....	Brooms.....				2 85					2 85
George A. Stanley.....	Lard Oil.....				37 60					37 60
Meriam & Morgan.....	Carbon Oil.....				17 68					17 68
M. L. Nelson.....	Cartage.....					36 50				36 50
Radcliff & Langell.....	Repair Work.....					8 86				8 86
Cleveland Rubber Co.....	Rubber for Valves.....					36 00				36 00
Harper & Curtiss.....	Pipe and Fittings.....					4 54				4 54
H. R. Worthington.....	Repairing Meter.....		15 00							15 00

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

## BOARD OF TRUSTEES OF WATER WORKS.

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BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	GENERAL EXPENSES.	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CRIBS REPAIRS.	WATER METERS.	CONSTRUC- TION.	TOTAL.
Jan.										
Fred. Fey	Wood		4 00							\$ 4 00
James Farnan	Ferrules, etc.		5 35	55 40						60 75
H. Hartman	Repairing Lanterns		5 65							5 65
Manning & Sons	Blacksmithing		6 18							6 18
Bingham, Clayton & Co.	Hardware, etc			3 40						3 40
Fairbanks, Benedict & Co	Advertising									20 00
B. P. Bower	Plumbing		56 35	55 12						111 47
Miller, Jamison & Co.	Estimate of W'r't Pipe.		1,887 85							1,887 85
Patrick Ready	Cartage Coal				14 97					14 97
Feb. Pay Rolls			237 80	1,574 05	1,209 33	156 94	120 00			3,268 12
Harper & Curtiss	Fittings, etc.					50 02				50 02
Bohm & Stubr	Wooden Plugs	3 85								3 85
William Bingham & Co.	Hardware			19 35						19 35
C. H. Clark	Coal			11 40						11 40
F. & H. Born	Plumbing			2 95						2 95
Cl. Gas Light & Coke Co.	Gas			1 57						1 57
Gibson, Roberts & Price	Tin Pipe		4 00							4 00
C. P. Born's Son	Hardware & Charcoal		19 65							19 65



## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	GENERAL EXPENSES.	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CRIB SU- PERSTRUC- TURE.	WATER METERS.	CONSTRUC- TION.	TOTAL.
Feb.										
Heston Packing Co.	Packing.....					64 87				64 87
J. J. Parsons	Packing and Sundries.....					39 56				39 56
James Farnan	Brass Extensions, etc.....					4 50				4 50
G. H. Barstow	Fire Clay.....					3 50				3 50
Edwards, Townsend & Co.	Brooms.....				3 00					3 00
V. Swain's Sons	Marline.....					75				75
Cuy. Steam Furnace	Repair on Engines.....					1,817 09				1,817 09
T. Whitaker	Binding Maps.....			35 00						35 00
K. Hartman	Galvanized Flanges.....	5 00								5 00
Miller, Jamison & Co.	Estim. on River Pipes.....	563 67								563 67
Mar.	Pay Rolls.....		233 54	1,576 61	1,938 50		135 00			3,927 65
Miller, Jamison & Co.	Final est. River Pipe.....	730 60								730 60
Manning & Sons	Valves and Blacksm'g.....	45 00	14 11							59 11
Worwick Manuf'g Co.	Fittings.....		5 50	39 95						35 45
Short & Forman	Printing a Stationery.....			30 65						74 50
Leader Printing Co.	Advertising.....								12 00	12 00
Oliver Iron Works	Repair Work.....					10 01				10 01
Heston Packing Co.	Packing.....					94 00				94 00

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

## BOARD OF TRUSTEES OF WATER WORKS.

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BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	GENERAL HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CRIBS SU- PERSTRUC- TURE.	WATER CONSTRU- TION.	TOTAL.
Mar. W. G. Le Felley	Blacksmithing				3 65			3 65
S. Bennett	Rep'g Thermometer				3 75			3 75
W. P. Southworth & Co.	Chimneys			65				65
Edwards, Townsend & Co	Soap			3 90				3 90
People's Gas Light Co.	Gas			21 35				21 35
Buckeye Rubber Co.	Gaskets	4 69						4 69
S. Burnes	Coal	4 00						4 00
C. H. Clark	Coal		4 00					4 00
W. Bingham & Co.	Hardware		4 95					4 95
Cleveland Gas Light Co.	Gas			70				70
John W. Nixon	Plumbing			5 75				5 75
E. Cushing	Office Rent		275 00					275 00
D. Carnegie				6 30				6 30
April Pay Rolls			1,320 62	1,508 06	1,268 05			4,096 73
Manning & Sons	Valves, etc	95 75	41 68	20 00				157 41
E. Sims	Dredging		3,000 00					3,000 00
Boston Machine Co.	Valves	1,250 00	460 00					1,710 00
Fred. Hempy	Plugs	20 10						20 10

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

BILLS RENDERED BY	FOR	PIPE EX- TENSION. REPAIRS.	GENERAL EXPENSES.	ENGINE HOUSE EXPEN- SES.	CRIBS. REPAIRS.	WATER CON- STRUCT- TION.	TOTAL.
April Cleveland Gas Lt. Co.	Fire Clay	6 00					6 00
..... Leader Printing Co.	Advertising		7 00				7 00
..... Fairbanks, Benedict & Co	Advertising		7 00				7 00
..... Waechter am Erie	Advertising		6 00				6 00
..... C. W. Kraus	Advertising		6 00				6 00
..... Backus Oil Co	Oil			44 10			44 10
..... Cobb, Andrews & Co.	Permit Books		36 75				36 75
..... L. A. Benton	Clocks		2 50				2 50
..... S. Brynes	Coal	4 00					4 00
..... K. Hartman	Repairing Lamps	1 25					1 25
..... Gardner, Clark & York	Cement	1 25					1 25
..... Rhodes & Co.	Coal			781 74			781 74
..... Meriam & Morgan	Oil			6 73			6 73
..... W. R. Girard	Coal	16 00					16 00
..... T. Ingram	Cityton Waste			48 40			48 40
..... Peoples' Gas Lt. Co	Gas			67 81			67 81
..... Geo. A. Manley	Oil			84 71			84 71
..... Union Water Meter Co	Water Meters		146 60				146 60

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	GENERAL EXPENSES.	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CHAS. SU- PERSTIC TUBE.	WATER CONSTRUCT- TION.	TOTAL.
John Carnegie	Draftman						135 00		\$ 125 00
V. Swain's Sons	Sheaves					2 63			2 63
J. W. Williams	Trees for Reservoir			4 00					4 00
Globe Iron Works	Ladies & Blacksmith's	11 25			6 60				17 85
May	Pay Rolls	141 00	1,435 02	1,608 39	1,170 54	114 13	80 00		4,549 08
Lake Shore Foundry	Pipe and Castings	807 16	1,598 43						2,405 59
Manning & Sons	Valves, etc.	74 40	71 27						145 67
Gibson, Roberts & Price	Pig Lead	292 75							292 75
Bell, Cartwright & Co.	Oak Plank	58 83							58 83
Upson & Walton	Rope	8 12							8 12
Fred Hempy	Plugs	3 00							3 00
S. Byerns	Coal	5 75							5 75
K. Hartman	Wicking & Repair Wk.	1 00	65		96				2 61
Roehl & Kiehn	Brick for Reservoir		35 00						35 00
Otto Konigalaw	Repairing Meters		4 25						4 25
J. W. Nixon	Plumbing			6 60					6 60
American Meter Co.	Water Meters			35 00					35 00
H. R. Worthington	Water Meters			41 65					41 65

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—(Continued.)

BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS, EXPENSES.	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CRIB ST- PUMPING TUBE.	WATER CONSTRUC- TION.	TOTAL.
May.	Union Water Meter Co.							476 06
	William Gaul		5 00					5 00
	Backus Oil Co.			40 00				40 00
	W. H. Parker & Co.			11 40				11 40
	Edwards, Townsend & Co.			5 50				5 50
	Strong, Cobb & Co.			3 00				3 00
	Cuy. Steam Furnace Co.				5 50			5 50
	Wm. Custiss & Cold				3 95			3 95
	J. J. Parsons.				15 94			15 94
	J. Turton				68 60			68 60
	Globe Iron Works.				30 64			30 64
	Wm. Bingham & Co.							33 38
	People's Gas Light Co.							15 06
	A. A. McDonell						510 00	510 00
June.	Pay Rolls	371 68	1,221 58	1,274 17				4,467 76
	Lake Shore Foundry	2,513 18	258 17					2,771 35
	Manning & Sons.	353 53	306 67					580 20
	R. D. Wood Co.	480 00						480 00

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	GENERAL EXPENSES.	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CHIEF ST- RUCTURE TUBE.	WATER SYSTEMS.	CONSTRUCT- TION.	TOTAL.
June. K. Hartman.....	Repairing Lamp.....		65							65
..... Cleve'd Cement Pipe Co.	Cement.....		2 50							2 50
..... S. Byrnes.....	Coal.....		6 15							6 15
..... Joseph Worak.....	Repairing.....		3 88							3 88
..... Haraley & Fielding.....	Paving.....		79 73							79 73
..... Thomas Gregory.....	Teaming.....		56 96							56 96
..... A. F. & H. Strater.....	Pig Lead.....		261 43							261 43
..... Sturtevant & Briggs.....	Horse and Wagon.....			8 00						8 00
..... Fritz & Trunk.....	Plumbing.....			8 60						8 60
..... Leader Printing Co.....	Paper.....			12 00						12 00
..... Walter Blythe.....	Plans for New Office.....			130 00						130 00
..... E. Cushing.....	Office Rent.....			275 00						275 00
..... Cleveland Rubber Co.....	Rubber Hose.....				9 00					9 00
..... Lyon & Whitelaw.....	Leather.....				50 00					50 00
..... Peoples' Gas Light Co.....	Gas.....				18 20					18 20
..... Backus Oil Co.....	Oil.....				40 40					40 40
..... Globe Iron Works.....	Iron.....				1 95					1 95
..... Fred Hempy.....	Wooden Plugs.....	4 20								4 20

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

	BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	GENERAL EXPENSES.	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CRIB SU- PERSTRUC- TURE.	WATER SU- PERSTRUC- TION.	CONSTRUC- TION.	TOTAL.
June.	Union Water Meter Co.	Water Meters.							450 80		450 80
.....	A. A. McDonell	Estimate.						2,880 00			2,880 00
.....	Reuben Bulman	Inspector.						35 00			35 00
.....	A. G. Smith	Judgment.							4,396 22	4,396 22	4,396 22
July.	Pay Rolls		878 72	585 76	1,578 56	1,386 88			243 96	243 96	4,568 88
.....	Manning & Sons.	Valves, etc.	680 18	30 23							640 41
.....	Lake Shore Foundry	Pipe Casting.	3,983 19								3,983 19
.....	Cleveland Gas Light Co.	Fire Clay.	12 00		1 57						18 57
.....	T. Ludington	Painting.			2 00						2 00
.....	Gibson, Roberts & Price.	Pig Lead.	245 88								245 88
.....	Plain Dealer Publ'g Co.	Advertising.	18 00		5 00				30 00	30 00	53 00
.....	Henry Steigmeier	Packing and Twine.	43 92	9 27							53 19
.....	Globe Iron Works	Iron and Machine Wk.	1 51	14 67			27 29				48 17
.....	William Bingham & Co.	Hardware, etc.	1 46	3 00	8 45	2 70					15 61
.....	S. C. Brooks.	Water Boxes.	22 00		139 55						151 55
.....	George Dennon & Co.	Repairing Sewer, etc.		209 50							209 50
.....	People's Gas Light Co.	Gas.				17 29					17 29
.....	Cuy. Steam Furnace Co.	Repair Work.		9 29							9 29

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

	BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	GENERAL EXPENSES.	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CRIBS & PERS- TRUC- TURE.	WATER CON- STRUC- TION.	TOTAL.
July	K. Hartman	Repairing Lamps.		2 40						2 40
	J. Stovering	Repairing Hydrants.		7 24						7 24
	Fairbanks, Benedict & Co	Adv. and Stationery			49 85	9 00				58 85
	Kemmer & Kushman	Estimate Freecooling ac			300 00					300 00
	A. Mehling				65 00					65 00
	Short & Forman	Stationery			7 10					7 10
	Cobb, Andrews & Co	Stationery			3 50					3 50
	S. P. Powell	Stub Book			1 25					1 25
	C. C. Dewstoe	Plumbing			5 02					5 02
	B. P. Bower	Plumbing		19 85	68 96					88 81
	Marchand & Son	Plumbing			44 75					44 75
	W. J. Morgan & Co	Eng. & Print'g Charts			12 00					12 00
	Strong & Cobb	Oils, Brush and Soap		1 50		3 35				4 85
	James Farnan	Ferrules & Numbers		208 74						208 74
	Worwick Mfg. Co.	Pipe and Fittings	46 64							46 64
	H. R. Worthington	Water Meters							120 50 } 457 50 }	578 00
	Union Water Meter Co.	Water Meters							297 30	297 30
	W. P. Southworth	Falls			1 80					1 80



## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

	BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	GENERAL EXPENSES.	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CHIEF SU- PERINTEN- DENT.	WATER SU- PPLY.	CONSTRUC- TION.	TOTAL.
July..	Edwards, Townsend & Co	Brooms				2 75					2 75
.....	Roehl, Koehn & Co	Brick			7 00						7 00
.....	Rhodes & Co	Coal				1,147 81					1,147 81
.....	A. A. McDonell	Estimate on Crib						8,303 31			8,303 31
.....	Otley Bros	Packing Cement				8 75					8 75
.....	S. Byrnes	Coal		3 90							3 90
.....	Reuben Bulman	Inspector						130 00			130 00
.....	H. E. Lavaye	Repairing Dock			460 36						460 36
.....	H. E. Lavaye	Repairing Dock			1,065 10						1,065 10
Aug..	Pay Rolls	Labor, etc	739 96	1,616 41	334 18	1,327 00		135 00		1,353 36	5,405 90
.....	Lak. Shore Foundry	Pipe and Castings	2,603 69								2,603 69
.....	J. Stovering	Repair Work		21 13							21 13
.....	Fred. Hempy	Wooden Plugs	7 70								7 70
.....	Henry Steigemier	Hemp Packing	26 40		6 47						32 87
.....	S. Byrnes	Coal			2 15						2 15
.....	George M. Smith	Stone Cutting			1 50						1 50
.....	K. Hartman	Repairing Lanterns		1 50							1 50
.....	E. H. Kellogg	Cylinder Oil				43 70					43 70

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	GENERAL EXPENSES.	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CRIB SU- PERSTRUC- TURE.	WATER METERS.	CONSTRUC- TION.	TOTAL.
Aug. R. D. Wood & Co.	Fire Hydrants	480 00								\$480 00
Gibson, Roberts & Price	Pig Lead	284 70								284 70
A. J. Marvin	Valves	331 80	\$ 30 85							351 65
William Bingham & Co.	Hardware		3 90	2 65						6 55
George Cooper & Co.	Enameled Duck		3 00							3 00
G. S. Newcomb & Co.	Binding Maps			25 00						25 00
Kemmer, Kushman & Co.	Frescoing & Painting			496 52						496 52
People's Gas Light Co.	Gas				14 88					14 88
Rhodes & Co.	Coal				129 46					129 46
Martin & Morris	Coal				49 35					49 35
Cuy. Steam Furnace Co.	Forging, etc.					6 58				6 58
Globe Iron Works	Forging, etc.					3 58				3 58
W. G. Le Pelly	Bld'g fence round WW								971 75	971 75
Mike Fielding	Paving		80 89							80 89
George A. Stanley	Lard Oil			30 60						30 60
John Ingram	Moving Building								50 00	50 00
W. S. Wight	Carpenter Work			300 00						300 00
Richardson & Hutton	Counter & Desk, etc			400 00						400 00

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	GENERAL EXPENSES.	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CRIB SU- PERSTRUC- TURE.	WATER CON- STRUCTI- ON.	TOTAL.
Aug. James Farnan.....	Brass Couplings.....					75			75
Bohm & Stuhr.....	Wooden Plugs.....	1 30							1 30
Union Water Meter Co.....	Water Meters.....						133 30		133 30
H. E. Lavaye.....	Bid'g and Rep'g Dock.....		731 50					731 50	1,443 00
A. A. McDonell.....	Estimate on Crib.....						8,111 13		8,111 13
Sept. Pay Rolls.....		929 51	283 33	1,612 45	1,238 46			46 50 937 33	5,067 58
Lake Shore Foundry.....	Pipe and Castings.....	3,230 32							3,230 32
Stovering & Co.....	Repair Work.....	10 00	6 87						16 87
Gibson, Roberts & Price.....	Pig Lead.....	219 14							219 14
R. D. Wood & Co.....	Hydrants.....	460 00							460 00
Lord, Bowler & Co.....	Valves, etc.....	542 70							542 70
John Wagner.....	Coal.....	4 00							4 00
H. Steigemeier.....	Hemp Packing.....	17 88	8 64						26 52
M. Fielding.....	Paving.....		5 27						5 27
Otto Konigalov.....	Repair Work.....		2 00						2 00
Richardson & Hutton.....	Office Desk, etc.....			550 30					550 30
W. S. Wright.....	Office Carpenter work.....			119 00					119 00
House & Davidson.....	Meter Boxes.....			5 00					5 00

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

## BOARD OF TRUSTEES OF WATER WORKS.

55

BILLS RENDERED BY	FOR	PIPE EX-GENERAL TENSION. REPAIRS.	GENERAL EXPENSES	ENGINE HOUSE REPAIRS. SES.	ENGINE HOUSE REPAIRS.	CRIB SU- PERSTRUC- TURE.	WATER CONSTRUCT- TION.	TOTAL.
Sept. Myers, Unl & Co.....	Marble Slabs		6 88					6 88
..... Wadsworth, Roberts & Co.....	Plumbing		8 15					8 15
..... Henry Sackman .....	Locks and Keys		14 50					14 50
..... E. Cushing .....	Office Rent		275 00					275 00
..... Worwick Mfg. Co.....	Fittings		2 97					2 97
..... Marchand & Son.....	Chandeller		30 00					30 00
..... Rhodes & Co.....	Coal			2,578 71				2,578 71
..... Meriam & Morgan.....	Oil			8 82				8 82
..... Leonard & Ellis.....	Oil			148 50				148 50
..... Fowler & Barnes.....	Oil			24 65				24 65
..... Cleveland Rubber Co .....	Hose			15 00				15 00
..... People's Gas Light Co.....	Gas			23 80				23 80
..... William Bingham & Co.....	Hardware			12 57				12 57
..... J. J. Parsons .....	Pipe, etc.				6 09			6 09
..... William Curtiss.....	Fittings				5 78			5 78
..... Globe Iron Works.....	Blacksmithing				3 25			3 25
..... Strong, Cobb & Co.....	Soap				4 82			4 82
..... Edwards, Townsend & Co .....	Brooms			5 45				5 45

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	GENERAL EXPENSES.	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CRIBS & PERSTRUC- TURE.	WATER CONSTRUC- TION.	TOTAL.
Sept. A. A. McDonnell.....	Estimate on Crib.....						5,819 88		5,819 88
H. E. Lavaye.....	Relaying Dock.....							1,936 46	1,936 46
J. H. Van Dorn.....	Iron Fence.....							1,945 13	1,945 13
Roehl & Koehn.....	Brick.....							162 00	162 00
Clev. Cement Pyre Co.....	Cement.....							52 78	52 78
Gardner, Clark & York.....	Cement.....							38 50	38 50
T. Simmons.....	Cement.....							18 26	18 26
George Dennon.....	Services.....							8 00	8 00
R. Bulman.....	Inspector.....						125 00		125 00
Union Water Meter Co.....	Water Meters.....							499 95	499 95
Walter Blythe.....	Services.....			100 00					100 00
Oct. Pay Rolls.....		230 15	445 78	1,668 86	1,235 99	3 01	135 00	573 43	4,375 19
Lake Shore Foundry.....	Pipes and Castings.....	697 51							697 51
Gibson, Roberts & Price.....	Pig Lead.....	160 92	3 17						164 09
Fred Hempy.....	Wooden Plugs.....	3 70							3 70
Moving & Co.....	Blacksmithing.....	6 73	24 05	1 05				6 65	38 48
M. Fielding.....	Paving.....		7 56						7 56
John Wagner.....	Total.....		6 00						6 00

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

## BOARD OF TRUSTEES OF WATER WORKS.

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PAY	BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CRIBS. PILING TYPE.	WATER CONSTRUC- TION.	TOTAL.
Oct.	K. Hartman	Repairing Lamps.		2 35					2 35
	V. Swain's Sons	Twine.		1 08					1 08
	W. Herron	Grain'g & Varnish'g			108 00				108 00
	Sterling & Co.	Linoleum.			110 61				110 61
	J. Krause & Co.	Matting.			19 50				19 50
	Worwick Mfg. Co.	Pipe and Fittings.			3 79				3 79
	Muldner & Leudy	Binding Maps.			25 00				25 00
	William Bingham	Hardware			13 71				13 71
	F. & H. Born	Plumbing.			4 66				4 66
	S. J. Pope & Co.	Air Regulators			8 00				8 00
	Marchand & Son	Gas Lighter.			2 50				2 50
	Cobb, Andrews & Co.	Stationery			2 28				2 28
	Cleveland Gas Light Co.	Gas.			4 35				4 35
	Cleveland Paper Co.	Stationery			2 00				2 00
	Rhodes & Co.	Coal			1,682 78				1,682 78
	People's Gas Light Co.	Gas.			35 38				35 38
	George A. Stanley	Oil			29 75				29 75
	Strong, Cobb & Co.	Oil			16 60				16 60

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

	BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	GENERAL EXPENSES.	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CHAS. ST. PERMANENT TUNING.	WATER METERS.	CONSTRUC- TION.	TOTAL.
Oct.	Edwarda, Townsend & Co	Brooms, etc.				7 15					7 15
	Globe Iron Works	Blacksmithing.					8 20				8 20
	B. H. Stair & Co.	Grass Seed.								21 00	21 00
	Gardner, Clark & Co.	Cement.								8 80	8 80
	George M. Smith	Monument Stones.								15 20	15 20
	Bell, Cartwright & Co.	Lumber.								122 51	122 51
	Cleveland Iron Co.	Iron Rails.								227 73	227 73
	Cuy. Steam Furnace Co.	Coal Cars.								516 86	516 86
	Union Water Meter Co.	Water Meters.							174 00		174 00
	James Harris	Sodding E. H. Lot.								444 66	444 66
	B. P. Bower	Plumbing.			271 48						271 48
	Leader Printing Co.	Advertising.			3 00						3 00
	Plain Dealer Print'g Co.	Advertising.			5 00						5 00
	Waechter am Erie.	Advertising.			6 00						6 00
	Fairbanks & Benedict.	Advertising & Reports.			45 50						45 50
	A. A. McDonell	Estimate on Crfb.						7,160 64			7,160 64
	Wilbur F. Hinman.	Court Costs.								314 90	314 90
Nov.	Pay Rolls.			387 77	1,679 39	1,294 00				63 44	3,363 50

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

## BOARD OF TRUSTEES OF WATER WORKS.

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	BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	GENERAL EXPENSES.	ENGINE HOUSE EXPEN- TURES.	ENGINE HOUSE REPAIRS.	CRIBS- PERSTRUC- TURE.	WATER CONSTRUC- TION.	TOTAL.
Nov.	Lord, Bowler & Co.	Valves	71 28	68						71 96
	J. Stovering & Co	Blacksmithing		93 52					3 02	96 54
	Globe Iron Works.	Repair Work		96 45						96 45
	M. Fielding	Paving		11 70						11 70
	Worwick Mfg. Co.	Pipes and Fittings			1 08	11 13			19 45	31 66
	Mullen & Fish.	Horse Hire.			8 08					8 00
	Myers, Uhl & Co.	Marble Slabs.			1 97					1 97
	Spankle, Morse & Co.	Salt			2 25					2 25
	Strong, Cobb & Co.	White Lead			2 68					2 68
	M. Kaufman	Advertising			6 00					6 00
	Short & Forman.	Stationery			1 75					1 75
	T. P. Ryan	Moving Safe.			10 00					10 00
	W. J. Gleason	P. D. Advertising			10 00					10 00
	Marchand & Son	Chandeller.			30 00					30 00
	William Bingham & Co.	Hardware			7 60	7 19			30 90	45 69
	Cobb, Andrews & Co.	Laws of Ohio			5 10					5 10
	C. H. Clark & Co.	Coal			7 50					7 50
	People's Gas Light Co.	Gas.				18 90				18 90



## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—(Continued).

BILLS RENDERED BY	FOR	PIPE EX- TENSION, REPAIRS, EXPENSES	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CRIB ST. HOUSE REPAIRS.	WATER CONSTRUC- TION.	TOTAL
Nov. James Farnan .....	Ferrules.....	102 92	1 25	.....	.....	5 25	109 42
G. H. Barstow .....	Fire Clay .....	.....	1 85	.....	.....	.....	1 85
Pratt & Co. ....	Asbestos.....	.....	5 00	.....	.....	.....	5 00
Heston Packing Co. ....	Packing .....	16 68	.....	.....	.....	.....	16 68
J. Turton .....	Painting .....	4 48	.....	.....	.....	.....	4 48
Edwards, Townsend & Co. ....	Brooms .....	.....	2 50	.....	.....	.....	2 50
Woodward .....	Fittings .....	.....	.....	9 90	.....	.....	9 90
J. J. Parsons .....	Copper, etc .....	.....	.....	12 75	.....	.....	12 75
W. Curtiss .....	Pipe and Fittings .....	.....	.....	6 24	.....	.....	6 24
Gibson, Roberts & Price .....	Pig Lead .....	.....	.....	18 95	.....	.....	18 95
H. R. Worthington .....	Water Meters .....	.....	.....	.....	200 00 { 255 04 }	.....	555 04
H. E. Lavaree .....	Tug Hire .....	.....	.....	60 00	.....	.....	60 00
Reuben Bulman .....	Inspector .....	.....	.....	45 00	.....	.....	45 00
W. S. Wight .....	Carpenter Work .....	.....	.....	.....	.....	54 95	54 95
M. E. Kavanagh .....	Repairing Plows .....	.....	.....	.....	.....	5 00	5 00
Gardner, Clark & York .....	Cement .....	.....	.....	.....	8 80	.....	8 80
Dec. Pay Rolls .....	Labor .....	845 87	1,648 30	1,284 16	98 00	.....	3,826 33
Lake Shore Foundry .....	Pipe and Castings .....	190 07	.....	.....	.....	.....	190 07

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—Continued.

BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	GENERAL EXPENSES.	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CRIB SU- PERSTRUC- TURE.	WATER CONSTRUC- TION.	TOTAL.
Dec. S. C. Brooks & Co.....	Carpenter Work.....	4 20	1 38	86 65					92 23
..... Lord, Bowler & Co.....	Valves.....	50 22	15 39						65 61
..... R. D. Wood & Co.....	Brass Hydrant Nuts.....	100 00							100 00
..... Fred. Hempy.....	Wooden Plugs.....	1 80							1 80
..... J. Stovering & Co.....	Repair Work.....		12 15	55					12 70
..... E. Cushing.....	Office Rent.....			275 00					275 00
..... Clev. Window Glass Co.....	Glass.....			2 10					2 10
..... Eclipse Iron Works.....	Ventilators.....			12 22					12 22
..... Cleveland Paper Co.....	Envelopes.....			2 80					2 80
..... Mrs. S. Pfeifer.....	Washing Towels.....			4 50					4 50
..... Cleveland Gas Light Co.....	Gas.....			16 95					16 95
..... A. T. Van Tassel.....	Hardware.....			2 65	4 90				7 55
..... K. Hartman.....	Repairing Lamps.....			4 50					4 50
..... Hartness & Huling.....	Soap Compound.....				81				81
..... J. J. Parsons.....	Lamps.....				1 20				1 20
..... People's Gas Light Co.....	Gas Bill.....				22 92				22 92
..... Clev. Cement Pipe Co.....	Cement.....				2 30				2 30
..... Strong, Cobb & Co.....	Oil, etc.....				3 57				3 57

## EXPENDITURES OF CLEVELAND WATER WORKS FOR THE YEAR 1877—(continued).

	BILLS RENDERED BY	FOR	PIPE EX- TENSION.	GENERAL REPAIRS.	GENERAL EXPENSES.	ENGINE HOUSE EXPEN- SES.	ENGINE HOUSE REPAIRS.	CRIBS & PIPERAC TUNES.	WATER CONSTRUCT TION.	TOTAL.
Dec.	W. Bingham & Co.	Hardware		3 97	1 30	62 25				67 43
	Globe Iron Works.	Blacksmithing.					67 59			67 59
	V. Swain's Sons	Rope, etc.					4 25			4 25
	J. Turton's Sons	Painting					1 50			1 50
	J. Farnan	Brass Work.					4 75			4 75
	W. H. Woodward	Zinc.					60			60
	H. R. Worthington.	Water Meters.			438 00					438 00
	A. F. & H. Strater	Setting Meters			8 00					8 00
	Worswick Mfg. Co.	Fittings			5 84					5 84
	Purdy, McNeil & Co.	Lumber.			15 72				37 65	53 37
	W. Gaul.	Cartage and Manure.			50 00					50 00
	M. Fielding	Re-laying Pavement.	13 52							13 52
	Payne, Newton & Co.	Coal				61 62				61 62
	Grove Coal Co	Coal				36 10				36 10
	Rhodes.	Coal				1,686 46				1,686 46
	Total.		\$25,108 07	\$18,312 92	\$36,166 27	\$24,405 19	\$21,081 48	\$23,435 76	\$2,617 04	\$147,069 81

## RECAPITULATION.

Pipe Extension.....	\$ 25,108 07
General Repairs.....	18,812 93
General Running Expenses.....	26,166 27
Engine House Expenses.....	24,405 19
Engine House Repairs.....	2,961 48
Crib Superstructure.....	33,485 76
Water Meters.....	2,697 64
Construction.....	13,932 47
Total Expenditures.....	\$147,069 81

The sum of \$1028.55 should be transferred from the Item of Labor in Engine House Expenses, to Engine House Repairs, to correspond with the Repairs Account, as kept by the Engineer of Pumping Works.



TWENTY-THIRD

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1902

# ANNUAL REPORT

OF THE

BOARD

OF

## Trustees of Water Works,

TO THE

CITY COUNCIL

OF CLEVELAND, O.

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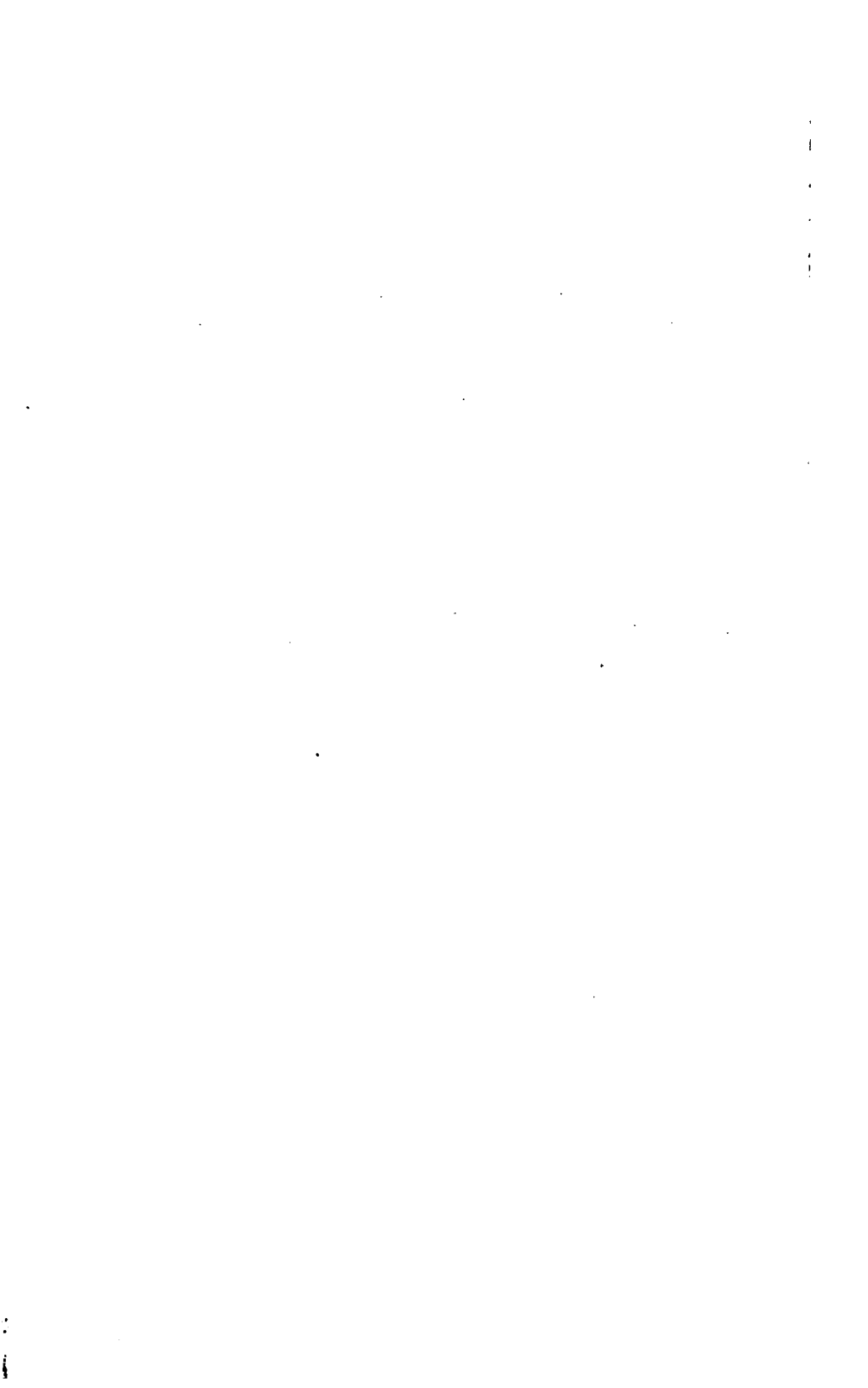
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1879.

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TWENTY-THIRD

ANNUAL REPORT

OF THE

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OF

Trustees of Water Works,

TO THE

CITY COUNCIL

OF CLEVELAND, O.

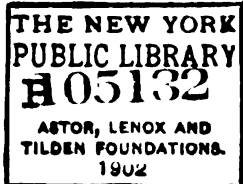


CLEVELAND, O.:

WISEMAN & HARVEY, PRINTERS, 105 SENECA STREET.

1879.





# REPORT OF TRUSTEES OF WATER WORKS.

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*To the Honorable the Mayor and Council of the City of Cleveland:*

GENTLEMEN:—We have the honor of herewith presenting for your consideration the Twenty-third Annual Report of the Board of City Water Works, and so vital are the interests of this Department to the city, and its citizens at large, that we ask from your honorable body a careful perusal of all the reports hereto appended from the various heads of the Department, believing that you will find them full, explicit and correct in all their details.

We believe the Department to be in a very prosperous condition and so substantially provided in all its equipment that no needed outlay will be demanded for many years, other than for general pipe extensions, the repairs on the crib, and the usual expenses of ordinary repairs.

We feel that the efficiency of the present officers in charge, and their diligent and faithful assistants, are deserving of much commendation, and the present efficiency of the Department is largely due to their faithful performance of duty.

The duties, especially of the Engineer in Chief, have the past year been exceedingly arduous, owing to the destruction by storm (as referred to in his report) of a portion of the superstructure at the crib.

We are in question as yet whether fault can be attached to any one on account of the damage accruing to this structure at the time of the storm referred to, but have the matter fully under advisement, and trust that at an early day we may be able to report to your honorable body a full statement of all the facts and conclusions arrived at. This we propose to do as early as the season will permit of a thorough examination by experts.

We are happy, however, to report that the sub-marine structure is in no way impaired, except as stated in the Superintendent's report, and can easily be made solid and permanent. We consider the structure, as a whole, as now protected, in a safe condition, and the repairs to be made can be done at the most propitious time without hurry or inconvenience to the regular routine of the ordinary demands of the Department.

The former ghastly appearance of the grounds about the pumping works have been much improved by laying out of the grounds, tree planting and sodding, and also providing against the flooding by surface water from the high bluffs in the rear.

The financial condition of the Department, as set forth by the Secretary, fully meets our expectation, and exceeds by several thousands of dollars his own estimate, as intimated in his former report. Exactness and cleanness are the characteristics of this office, and must meet the approval of all citizens.

A careful inspection at any and all times at the pumping works will reveal to the most critical the perfect order and decorum prevailing there. The improvements in new boilers at these works, to which Mr. Doty, the engineer in charge, refers in his report, are of the most substantial kind, and have ample steam capacity for present needs and abundant reserve for any emergency. We believe they were wisely planned and skillfully made, and from tests thus far fully meet our expectation.

With all the working departments under the direct supervision of the Engineer in Chief, with his practiced eye and habits of industry and economy, we feel we can bespeak for the future

BOARD OF TRUSTEES OF WATER WORKS.

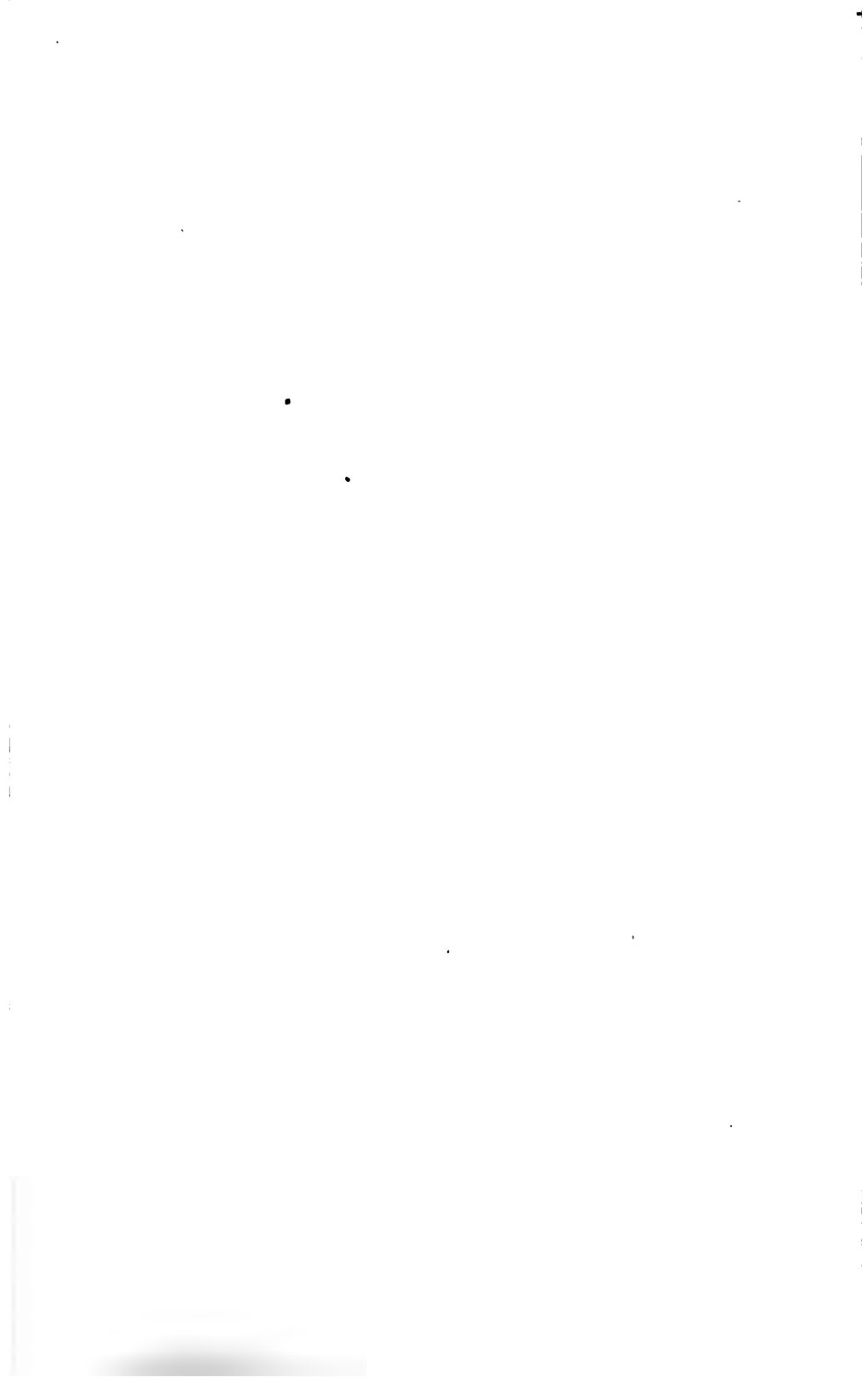
continued prosperity, and at no distant day a more than self-sustaining department.

All of which is respectfully submitted.

ETHAN ROGERS,  
TRUMAN DUNHAM,  
N. P. BOWLER,

*Trustees of Water Works.*

Cleveland, March 6th, 1879.



# REPORT OF THE

## Secretary of the Board of Trustees.

*To the Board of Trustees of Water Works:*

GENTLEMEN:—In compliance with law I respectfully submit the following Annual Report.

The receipts and disbursements of this Department for 1878 and balances of cash are as follows:

### RECEIPTS.

Cash in City Treasury, January 1, 1878.....		\$55,326 22
Cash in Water Works Office, January 1, 1878.....		236 12
For Water, Including Permits, viz.:		
From Assessments.....	\$115,056 52	
From Meter Measure.....	45,577 96	
	160,634 48	
Less Amount Refunded.....	508 78	
		160,125 70
For Bills Receivable, Street Sprinkling Certificates.....		4,375 03
For Interest on Same.....		491 92
On Pipe Extension Account.....		919 94
On Office and General Expense Account.....		105 00
On General Repairs Account.....		101 69
On Engine House Expense Account.....		9 00
On Lake Crib Superstructure.....		1 00
Total.....		\$221,681 62

## DISBURSEMENTS.

BILLS AND PAY ROLLS CERTIFIED TO THE CITY AUDITOR FOR  
PAYMENT FROM THE WATER WORKS FUND.

For Office and General Expenses.....	\$21,738 98
For General Repairs .....	5,878 33
For Engine House Expenses .....	24,353 06
For Repairs at Engine House.....	1,057 90
For Pipe Extension .....	27,257 58
For Water Meters.....	1,729 56
For Final Payment Engine, etc., (Construction Account)	8,239 87
For Interest on Deferred Payment on Engine .....	1,923 50
For New Boilers, Fittings, and Setting Same. ....	18,888 37
On Lake Crib Superstructure Account .....	16,612 86
On Lake Crib Protection Account .....	10,920 98
On Lake Crib Repairs Account .....	15,619 37
	<hr/>
	\$154,170 36
For Payment of Interest on Water Works Bonds.....	35,000 00
Cash in City Treasury Subject to Draft, Jan. 1, 1879.....	31,159 31
Cash in Water Works Office, Jan. 1, 1879 .....	1,351 95
	<hr/>
Total.....	\$221,081 62

For a detailed account of the expenditures reference may be had to the statement accompanying the report of the Superintendent and Engineer.

The expenditures for the ordinary running expenses and repairs for the year, after deducting credits to the several accounts and transferring twelve hundred and five dollars and forty cents to the debit of the general expense account—from the meter account for the estimated depreciation in value of water meters from wear and damage, are as follows:

For office and general expenses, . . . . .	\$22,839 38
For general repairs, . . . . .	5,776 64
For expenses at engine house, . . . . .	24,344 06
For repairs at engine house, . . . . .	1,057 90
	<hr/>
	\$54,017 98

The receipts for water for 1878 are in excess of the previous year the sum of seven thousand, three hundred and thirty-one dollars and two cents.

I estimate that the receipts for water for the year 1879 will amount to one hundred and sixty-five thousand dollars, and that the ordinary expenses and repairs will not exceed fifty-five thousand dollars.

The present liabilities of the Department, except bonded, are about ten thousand dollars.

The various departments of the city enumerated below are supplied with water without charge:

*School Department.*—Twenty principal school buildings and several smaller ones.

*Fire Department.*—Eleven engine houses, also eight hundred and seventy-three fire hydrants and a number of cisterns.

*Police Department.*—The Central and five precinct stations.

*Infirmary Department.*—The Infirmary on Scranton avenue and office on Champlain street.

*Workhouse Department.*—The Workhouse on Woodland avenue.

Water is also furnished without charge to the City Hall building and the elevator used therein, the market houses, parks, cemeteries, armory, for flushing sewers, puddling streets, and for other public uses, requiring in the aggregate a large quantity of water; and in case the same was paid for at tariff rates, the receipts for water would be largely increased.



## LEDGER BALANCE, JANUARY 1, 1879.

FACE OF LEDGER.	DR.	CR.
Construction.....	\$2,472,978 63	
Interest.....	31,740 73	
Water Meters.....	10,848 68	
City Treasurer.....	31,150 31	
Cash.....	1,351 95	
Bonds Outstanding.....		\$1,300,000 00
Bonds Redeemed.....		425,000 00
Water Rent Income.....		774,605 70
City of Cleveland.....		48,473 60
Total.....	\$2,548,079 30	\$2,548,079 30

## BONDED DEBT.

The bonded debt of the city for Water Works purposes has been decreased during the year by the payment from the Sinking Fund of four hundred and twenty-five thousand dollars of matured bonds, leaving the amount of outstanding bonds as follows:

Six Per Cent. Bonds Due July 1, 1879 .....	\$ 25,000 00
Seven Per Cent. Bonds Due October 1, 1880 .....	75,000 00
Seven Per Cent. Bonds Due January 1, 1881 .....	100,000 00
Seven Per Cent. Bonds Due January 1, 1884 .....	300,000 00
Seven Per Cent. Bonds Due May 1, 1892 .....	400,000 00
Seven Per Cent. Bonds Due May 1, 1893 .....	200,000 00
Six Per Cent. Bonds Due October 1, 1895 .....	200,000 00
Total.....	\$1,300,000 00

The payment of all Water Works bonds that mature on or before January 1, 1884, will also be made from the Sinking Fund.

No special provision has been made for the payment of bonds maturing subsequent to that time.

Respectfully submitted,

H. C. HAWKINS.

CLEVELAND, March 6, 1879.

*Secretary.*



## REPORT OF THE Superintendent and Engineer.

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*To the Board of Trustees of Water Works:*

GENTLEMEN:—The undersigned would respectfully submit the following Annual Report upon the condition of the Works under his charge:

### LAKE CRIB.

The work remaining to be done to complete this structure, at the beginning of the season, was the setting of the two upper courses of masonry on the exterior wall, the building of the top series of brick arches, the putting on of the roof and the completion of the joiner work in the living rooms.

This work, with the exception of the roof, was finished early in July when the outer timber structure was removed by the contractor down to the water line, preparatory to the work of cutting the timbers off on a level about one foot above the base of the masonry. The timbers were then to be plated with heavy boiler iron on the top and down the face to preserve them from the injurious action of ice.

On the 22d day of July and before any of this work could be done a storm came on and carried away the timbers on the north face to a depth of five feet below the water line, exposing some of the loose stones with which the sub-structure is filled, to the action of the waves, and slightly displacing five or six of the outer stones in the foundation. These loose stones were secured from further movement by oak wedges, and steps were

taken to replace the timber as early as possible. This it was determined to do in a complete section, as an examination of the lower timbers seemed to indicate that some of them were split lengthwise and that the new work could only be made fast to the old by making it double thickness down to the old work, the outer course to extend four feet deeper, the lower part to be bolted to the old timber, the angles to be secured by iron plates.

Early in September Capt. Geo. H. Breyman, sub-marine diver, was engaged to prepare the top of the old timber to receive the new work and to secure the new timber in place.

Everything had been made ready and suitable weather for doing the work was anxiously awaited, but on the 11th a storm came on and lasted until the night of the 13th. After withstanding the storm for forty-eight hours the stones which had previously been loosened were washed out by the great force of the waves during the morning of the 13th. The waves then having access to the loose stones in the sub-structure the wall was soon undermined and the courses of masonry dropped successively into the cavity thus formed. In this manner the north wall and portions of the east and west walls were carried away.

As soon as the debris could be removed the timber section already mentioned was taken out and an attempt made to put it in place, but before it could be properly secured another storm came on and broke some of the fastenings and to prevent further damage it was towed ashore to await more favorable weather. Nearly a week elapsed before the lake was still enough to make the second attempt which, this time, proved successful, the divers working uninterruptedly for seventy-two hours.

Immediately after the masonry fell preparations were made to rebuild the timber walls up to the roof on the sides that had been carried away. The work proved to be exceedingly tedious and at times almost discouraging on account of the continu-

ous winds and consequent disturbance of the surface of the lake rendering sub-marine work near the surface or work just above the surface impossible, but by taking advantage of every moment, night or day, when the lake was still enough to permit work to be done, it was finally accomplished, the last trip out being made on the 24th day of December. The structure is now considered safe against the action of storms or floating ice.

The work of repairs was under the immediate charge of Mr. John Carnegie, to whose untiring industry, in a great measure, its successful accomplishment is due. Capt. Geo. H. Breyman is also deserving of special mention for his endurance and skill in doing the work under water. The cost of the work will be found in the table of expenditures hereto attached. A large quantity of stone has been thrown into the lake around the Crib. The effect is apparent in the increased stability of the structure during storms.

#### LAKE TUNNEL.

There has been no interruption to the flow of water through the tunnel since its opening five years ago, and for the past year the quality of the water has been unexceptionable. After the accident to the Crib, as a measure of precaution, a heavy covering of oak timber was fastened to the top of the inlet shaft to keep out any material that might fall in case of accident to the inner wall of the Crib.

#### ENGINE HOUSES AND MACHINERY.

The Engineer in charge of the pumping works has, in his report, given such a clear statement of the condition of the buildings and machinery under his care that it is not necessary here to add anything to what has been said. The recommendation to paint and repair the north building and the machinery therein contained as soon as the Cornish boilers are set in place, deserves your approval.

## PUMPING MAINS.

The pumping mains are both in good order, only two insignificant leaks having shown themselves during the year. The surface of Kentucky street hill over the main pipes has been covered with clay to prevent the sand from washing out and undermining the pipes during heavy rain storms.

## RESERVOIR AND GROUNDS.

The work of cleaning out the Reservoir was commenced April 22d and completed May 2d. While this was being done the water was all drawn off from both compartments at the same time, the supply to the city during the interval being pumped directly through the main pipes. The deposit of sediment was the least ever known, being less than three inches on the bottom and not to exceed one inch on the slopes. So small an accumulation of sedimentary matter during a period of four years is an evidence of the purity of the water furnished since the opening of the lake tunnel, previous to which time the annual deposit averaged about six inches.

The old wooden bridges leading to the valve rods have been removed. A stone slab with gauge marks has been set flush with the slope of the face of the embankment. The fence and railing on the top of the embankment and the fence on the line of Kentucky street received each two coats of paint. The grass on the outer slopes as also on the other portions of the lot was never in better condition.

## PIPE SYSTEM.

Only two serious leaks have occurred in the distributing mains during the year, one of them being an annular fracture in the thirty inch line in Bridge street probably caused by unequal settlement of earth under it and near the line of a main sewer. It was repaired in the usual manner by putting on cast iron clamps over the fracture.

The other leak was in the twenty inch line at the joint next west of the one connecting the river and land pipes opposite the

foot of Superior street and was doubtless caused by the settlement of the pipe under the river. It was repaired by covering the whole joint with a socket clamp and filling the space between that and the pipe with lead.

The total length of pipe of the different sizes from three inches diameter upwards now in use is 113 miles and 2670 feet, 5 miles and 2943 feet having been laid during the past year.

The total number of stop-gates is 1957 ; of this number 102 were set the past year.

There are now set and in good order 873 fire hydrants, 56 of which were set during 1878.

For particulars as to length, size and location of pipe laid and the location and size of gates and fire hydrants set, see accompanying tables.

## METERS.

There are now in use 291 water meters. Of this number 43 were set in 1878. The number of each of the different sizes in use is as follows:

3	.	.	4	inch	.	.	Worthington.
13	.	.	3	"	.	.	"
2	.	.	3	"	.	.	Union Rotary.
35	.	.	2	"	.	.	Worthington.
35	.	.	1½	"	.	.	"
4	.	.	1½	"	.	.	Ball & Fitts Piston.
61	.	.	1	"	.	.	" "
27	.	.	1	"	.	.	Worthington.
38	.	.	¾	"	.	.	"
73	.	.	¾	"	.	.	Ball & Fitts Piston.

Total, 291

In addition to these meters there are 21 hydraulic elevators, to each of which is attached a register that records the quantity of water used.

The quantity of water sold, by meter measurement during the year was 431,576,940 gallons. The total quantity pumped



was 2,892,946,283 gallons, making the daily average consumption 7,925,882 gallons, an increase of only 198,962 gallons over the daily average for 1877, notwithstanding an increase in the number of service pipes in use of 624.

## SERVICE PIPES.

The number of new service connections made during the year was 603, as follows:

4 inch,	-	-	-	-	4
3 " "	-	-	-	-	1
2½ " "	-	-	-	-	1
2 " "	-	-	-	-	5
1½ " "	-	-	-	-	4
1¼ " "	-	-	-	-	1
¾ " "	-	-	-	-	19
½ " "	-	-	-	-	568
Total,	-	-	-	-	603

The total number of service pipe connections made with the distributing mains since the construction of the works, with the different sizes of the same, is as follows:

6 inch,	-	-	-	-	1
4 " "	-	-	-	-	30
3 " "	-	-	-	-	31
2½ " "	-	-	-	-	1
2 " "	-	-	-	-	62
1½ " "	-	-	-	-	21
1¼ " "	-	-	-	-	3
1 " "	-	-	-	-	104
¾ " "	-	-	-	-	372
½ " "	-	-	-	-	9,417
Total,	-	-	-	-	10,042

There are 1,658 service pipes not in use, some of which have been permanently discontinued, others are shut off temporarily.

but the greater number have never been extended beyond the curb line of the street.

The number in actual use on the 31st day of December, 1878, was therefore 8,384, making an increase of 624 for the year. This number does not include the service pipes laid in the village of West Cleveland, that corporation being counted as one customer only, the water supplied being measured by an eight inch meter set on the corporation line, as agreed upon by the two corporations.

#### GENERAL.

Pursuant to an agreement made by your predecessors with the corporate authorities of the village of West Cleveland, an eight inch water pipe was laid in Detroit street to the westerly line of the city, and at that point connected with the pipe system previously laid by the authorities of that village. The water passes through an eight inch water meter set on the westerly line of the city, and is paid for semi-annually at this office by the village authorities at the rate of fifteen cents for each thousand gallons registered.

The cost of pumping in 1877 was \$6.02 for each million gallons pumped one hundred feet high. The cost of doing the same work in 1878 was \$5.49. The cost of pumping each million gallons into the reservoir, which is 160 feet high, was therefore  $84\frac{8}{10}$  cents less in 1878 than in 1877.

The items entering into the cost of pumping water will be found under the head of "Engine House Expenses" and "Engine House Repairs" in the appended tables of expenditures.

The amount received for each million gallons of water pumped in 1878 was \$1.10 more than in 1877, which, added to the saving in the cost of pumping, makes the increase in receipts for each million gallons pumped  $\$1.94\frac{8}{10}$ .

This increase in the amount received is not due to any increase in the water rates, for they remain the same, but is due to a decrease in the amount of water wasted, as will be seen in the table showing the quantity of water pumped each year since

the construction of the works, together with the percentage of increase for each year. In that table it will be seen that the increase for the year 1878 was only  $2\frac{57}{100}$  per cent., while the increase in the number of water takers for the same time was  $7\frac{44}{100}$  per cent. The decrease in water wasted may be attributed partly to the increased number of meters, but mainly to the very mild winter weather falling within the year.

The quantity of pipe that will be required for the coming season will, probably, not greatly exceed that laid in 1878. The funds available for that purpose will be ample.

Respectfully submitted,

JOHN WHITELOW,

*Engineer and Superintendent.*

CLEVELAND, Feb. 20, 1879.

## REPORT OF THE

# Engineer in Charge Pumping Works.

---

*To the Board of Trustees of Water Works:*

GENTLEMEN:—The operations of the Pumping Works have not been interrupted during the year just closed, although important changes have been made involving necessarily much risk at times.

### BOILERS.

The condition of the boilers in the north building having been set forth in my Report for 1877 and your subsequent action renders it possible for me to report the following important changes and improvements:

The boilers known as the new Cornish have been removed from the south building with a view to placing them in the north building the coming spring where they are much needed and better adapted than in their former place. Their place has been filled with four new boilers of the Marine or return flue variety constructed in a manner best adapted to our circumstances and set with a view to the greatest economy and convenience, adding at least 33 per cent. to the capacity of this building and developing a saving of 20 per cent. in fuel. This work having been begun late in the season (Aug. 8th) two of the boilers are not quite ready for use, but the others have been thoroughly tested and fully meet our expectations.

These boilers were constructed at the Cleveland Steam Boiler Works, Mr. D. Connelly, proprietor, under the direct supervision of Mr. Jacob Newman, long and favorably known in connection with the boiler works of the Cuyahoga Steam Furnace Co. No boiler repairs have been necessary since the new Cornish boilers were rebuilt in 1876. When the present plans are carried to completion viz: The new Cornish boilers placed in the north building the boilers will require no additional expenditure of money for many years and the boiler capacity will be largely in excess of the present engine capacity.

#### CORNISH ENGINES.

At the close of 1877 the main pump to the west Cornish engine was receiving a new lower valve chamber. This work was completed and the engine ready for service February 26th, 1878. Since that time no expense for repairs has been necessary on that engine. The repairs referred to as necessary on the east Cornish engines in my Report for 1877 have been made which places both Cornish engines and pumps in good order.

#### CUYAHOGA ENGINES.

June 12th plans were submitted anticipating improvements of some importance in the Cuyahoga engines. After proper consideration these plans were adopted, consisting principally in putting counterbalances upon the main steam valves. This work was completed August 6th, and the performance of the engines since has fully justified the expense incurred, as it secures an additional four inches of stroke, equal to about 10 per cent., with no corresponding expense for fuel. These improvements and some repairs of minor importance constitute all the expense upon these engines excepting the necessary attendance. They are in good repair and are held in reserve ready for service at any moment.

#### WORTHINGTON ENGINES.

After two and a half years almost constant service without accident and with very little expense aside from attendance 1

can report the Worthington engines in good repair and doing regular daily service. Circumstances incident to changing boilers in this building compelled us to depend upon these engines principally for the supply of water since the 9th of September, and the severe weather the latter part of December required unusual effort to keep up the supply. These engines delivered water into the pipes at the rate of twelve million gallons in twenty-four hours, two million more than their guaranteed capacity, establishing a record that should clear up all doubt in regard to the wisdom of their purchase.

AMOUNT OF REPAIRS AND IMPROVEMENTS UPON EACH ENGINE  
FOR 1878.

	REPAIRS.	IMPROVEMENTS.
Cuyahoga Engines, - - -	\$108 52	\$627 20
Worthington Engines, - - -	46 11	
East Cornish, - - - - -	79 17	
West Cornish, - - - - -	520 35	

The item under the head of Improvements will be understood as expense incurred in putting in counterbalances, &c., upon the main steam valves mentioned in article on Cuyahoga engines.

—  
GENERAL.

The improved appearance of the inside of the south building since the walls were finished is more in keeping with the surroundings, but the delay of the contractors in carrying out the plans for gallery and staircase leaves the room still in an unfinished condition. We look forward with much interest to the time when this work shall be completed, as it will give us access to the upper rooms, which have been fitted up for drafting and store rooms.

Since the south building was erected the old house has been somewhat neglected in regard to painting, &c. I would, therefore, recommend that when the boilers are in their places and

ready for service the engines, walls and wood work be painted and such other repairs made as are needed upon the building.

The coal sheds so long under contemplation are not yet a reality, but I am aware that work of more importance has occupied your time and required the means necessary for this work. We are in possession, however, of a new set of scales for weighing coal and other supplies consumed at the works, a much needed improvement.

A comprehensive tabular statement of the performance of each engine is herewith annexed, to which your attention is invited.

Respectfully submitted,

R. DOTY,

*Engineer in Charge of Pumping Works.*

## TABULAR STATEMENTS.

The following pages contain tabular statements showing the work of engines, distribution of water, extension and laying of pipes, location and number of stop-gates and hydrants set, abstract of expenditures, &c :





## WORTHINGTON DUPLEX ENGINE, RECORD FOR 1878.

MONTH.	DAY.	PUMPING.		COAL CONSUMED.		Total.	GALLONS OF WATER PUMPED.	HEIGHT IN FEET AND DECIMALS.	DUTY.
		Hours.	Minutes.	Strokes.	Raising Steam.	Pumping.			
January.....	31	737	55	376,778	2,400	846,000	253,002,380	157.290	38,297,176
February.....	23	524	25	275,452	.....	575,471	170,780,240	157.304	38,048,974
March.....	25	569	10	282,522	3,800	516,056	162,763,640	157.037	41,430,477
April.....	26	583	.....	278,065	3,400	628,184	172,412,700	156.738	38,983,030
May.....	16	359	.....	177,546	2,900	399,647	110,078,520	156.530	38,077,281
June.....	30	703	15	398,382	.....	765,700	228,384,440	156.707	38,005,650
July.....	31	742	20	413,343	000	865,800	256,272,080	156.771	38,815,505
August.....	23	480	35	295,111	1,600	513,900	164,368,820	157.148	42,044,004
September.....	30	711	10	398,289	2,000	698,800	228,337,940	157.025	42,918,916
October.....	31	739	35	336,068	.....	575,600	208,374,560	157.341	47,645,619
November.....	30	717	15	319,408	3,400	549,400	198,032,060	157.419	47,463,583
December.....	31	744	.....	396,317	1,400	796,200	245,710,540	157.470	45,831,496
Totals and Averages.....	327	7,821	40	3,857,299	21,400	7,641,358	2,379,125,380	157.062	40,905,115

## HENDERSON DUPLEX ENGINE, RECORD FOR 1878.

MONTH.	DAY.	PUMPING.		COAL CONSUMED.			Total.	GALLONS OF WATER PUMPED.	HEIGHT IN FEET AND DECIMALS.	DUTY.
		Hours.	Minutes.	Strokes.	Raising Steam.	Pumping.				
February	10	145	30	91,503	1,200	235,396	296,596	46,758.033	157.650	29,302,480
March	8	172	30	100,117		223,044	223,044	52,004.432	157.502	31,056,723
April	6	128	50	87,738	800	174,016	175,416	42,272.108	156.749	31,708,776
May	17	381	45	283,612	1,200	553,453	554,753	128,645.099	156.957	30,204,075
June	3	16	35	12,069	2,800	35,805	38,605	5,971.228	156.611	21,824,424
August	14	263	25	174,497		360,300	360,300	93,862.023	157.256	31,568,691
Totals and Averages.	58	1,106	85	738,536	6,100	1,582,584	1,588,684	370,112.953	157.081	30,576,417

## RECORD OF CORNISH ENGINES FOR THE YEAR 1878—EAST ENGINE.

MONTHS.	DAYS.	PUMPING.		COAL CONSUMED.			HEIGHT IN FEET AND DECIMALS.	DUTY.
		Hour.	Minute.	Strokes.	Raising Steam.	Pumping. Total.		
August.....	20	161	05	74,125	24,600	64,000	23,784.125	48,004.366
October.....	26	211	05	97,325	28,800	105,800	31,241.325	38,855.509
December.....	16	105	10	40,575	20,200	40,000	15,913.575	42,877.208
Totals and Averages..	62	477	20	221,025	71,600	218,800	70,940.025	42,711.039

## RECORD OF CORNISH ENGINES—WEST ENGINE.

MONTHS.	DAY	Hour	PUMPING.		COAL CONSUMED.			GALLONS OF WATER PUMPED.	HEIGHT IN FEET AND DECIMALS.	DUTY.
			Minutes	Strokes.	Raising Steam.	Pumping.	Total.			
March.	1	2	30	925	30,000	1,300	21,200	290,925	157 106	32,521,853
May	5	36	35	17,400	18,400	17,300	35,000	5,014,300	157 083	42,879,385
June	12	101	55	47,225	19,200	40,500	59,700	15,150,225	156 836	49,090,132
July	18	144	50	68,025	36,000	65,300	91,400	22,124,025	156 944	44,539,350
September	12	102	30	47,725	21,900	51,000	72,400	15,319,725	157 287	30,511,062
November.	14	96	50	44,375	12,400	47,400	59,800	14,244,375	157 547	30,565,708
Totals and Averages	62	498	10	229,065	118,400	222,500	340,400	72,750,405	157 142	42,974,117
BOTH ENGINES.										
East Engine	62	477	20	221,025	71,000	218,800	290,400	70,949,025	157 502	42,711,099
West Engine.	62	498	10	229,065	118,400	222,500	340,000	72,750,405	157 142	42,974,117
Totals and Averages	124	965	30	447,090	190,000	441,300	631,300	143,708,480	157 322	42,842,578



ANNUAL REPORT OF TOTALS AND AVERAGES FOR BOTH CORNISH ENGINES FOR EACH YEAR SINCE THE  
CONSTRUCTION OF THE WORKS. CONTINUED.

YEARS.	PUMPING.		COAL CONSUMED.			GALLONS OF WATER PUMPED.	AVERAGE HEIGHT IN FEET AND DECIMALS.	DUTY.
	Hours.	Minutes.	Strokes.	Raising Steam.	Pumping.	Total.		
1871 .....	8948	35	4,230,500	65,200	4,322,400	4,385,600	157.781	41,108,940
1872 .....	10562	57	5,253,495	43,200	5,430,800	5,473,000	156.377	40,788,146
1873 .....	12808	50	5,824,825	13,600	6,122,300	6,135,900	157.896	40,031,963
1874 .....	11063	05	5,103,325	37,500	5,370,400	5,413,800	157.400	40,000,069
1875 .....	651	07	321,415	143,500	334,565	483,065	158.180	27,775,460
1876 .....	3019	40	1,362,428	128,304	1,363,400	1,321,794	156.662	33,130,569
1877 .....	630	55	315,635	122,000	334,600	456,600	158.318	27,625,975
1878 .....	965	30	447,680	190,000	441,300	631,300	157.322	42,842,578

## SCHEDULE SHOWING THE DISTRIBUTION OF WATER FOR EACH MONTH AND DAY IN THE YEAR 1878.

MONTHS.	GALLONS OF WATER PUMPED.			GALLONS DISTRIBUTED.			
	Cornish Engine.	Henderson Duplex Engines	Worthington Duplex Engines	Per Month.	Average Per Day.	Each Inhabitant per day.	Each Consumer Per Day.
January.....			253,602,300	253,602,300	7,555,500	48 61	127 86
February.....		46,758,033	170,780,240	217,538,273	7,060,224	50 12	132 38
March.....	296,025	52,604,432	162,763,640	215,664,067	6,956,185	44 88	118 54
April.....		42,272,168	172,412,700	214,684,868	6,956,162	44 88	118 52
May.....	5,614,200	128,645,069	110,078,520	244,337,879	7,881,897	50 85	134 30
June.....	15,150,225	5,071,228	228,384,440	240,514,893	8,317,163	53 06	141 71
July.....	22,124,025		256,272,000	278,397,505	8,980,567	57 94	152 68
August.....	25,794,125	463,862,023	164,308,820	292,024,968	9,067,579	58 60	155 01
September.....	15,319,725		228,357,940	243,657,665	8,121,822	52 40	128 30
October.....	31,241,325		206,374,560	230,615,885	7,720,544	49 86	131 70
November.....	14,244,375		196,032,000	212,277,335	7,075,911	45 65	120 56
December.....	15,913,575		245,716,540	261,630,115	8,438,061	54 44	143 80
Totals and Averages.....	143,808,400	370,112,953	2,379,125,380	2,862,946,823	7,825,802	51 13	135 05



**SCHEDULE SHOWING THE TOTAL AND AVERAGE QUANTITIES OF  
WATER PUMPED EACH YEAR SINCE THE CONSTRUCTION  
OF THE WORKS.**

YEARS.	GALLONS DISTRIBUTED.				Per Cent. of Increase.
	Per Year.	Per Day.	Each In- habitant Per Day.	Each Consumer Per Day.	
1857.....	127,282,265	348,064	7.75	110.68	.....
1858.....	142,155,434	398,467	8.37	98.44	11.70
1859.....	198,284,000	513,107	11.31	91.27	30.45
1860.....	200,220,354	710,984	14.11	101.57	31.87
1861.....	322,175,022	881,509	16.32	114.50	23.81
1862.....	309,673,002	1,012,794	19.47	120.57	14.74
1863.....	420,790,875	1,152,875	20.97	117.54	12.83
1864.....	476,114,225	1,300,858	21.68	123.89	12.14
1865.....	517,261,005	1,417,153	21.80	122.70	8.64
1866.....	587,372,220	1,609,239	22.35	124.26	13.55
1867.....	600,300,375	1,607,861	23.85	115.98	18.55
1868.....	768,786,975	2,106,265	24.77	116.08	10.40
1869.....	808,939,425	2,462,839	27.36	120.20	16.92
1870.....	1,126,224,500	3,085,558	30.86	113.20	25.28
1871.....	1,367,621,100	3,746,907	35.68	124.80	21.43
1872.....	1,686,370,895	4,607,571	40.07	131.64	22.67
1873.....	1,869,768,835	5,095,230	43.06	137.71	10.85
1874.....	2,050,252,910	5,625,150	45.36	141.10	9.65
1875.....	2,216,775,816	6,073,358	44.00	136.85	8.12
1876.....	2,309,225,403	6,573,220	49.22	131.28	8.23
1877.....	2,820,326,074	7,726,920	55.91	142.24	17.55
1878.....	2,892,946,823	7,925,882	51.13	135.05	2.57

SCHEDULE SHOWING THE EXTENSION OF WATER PIPE IN 1878.

SIDE.	SIZE.	STREET.	BETWEEN WHAT POINTS.	FEET LAID.	TOTAL.	REMARKS.
South..	8 inch.	Clark Avenue	Tee in Burton, west	48		
South..	8 "	Cedar Avenue	E. L. Willson to Harnet	2,010		
South..	8 "	Detroit.	From 182 feet west of Oakland to City Limits	1,071		
East	8 "	Gordon Avenue	Across Detroit.	66		
North..	8 "	Payne Avenue	Tee in Wason to Tee in Dayton	145		
North..	8 "	Payne Avenue	Tee in Aaron to 56 east of Buckeye.	253		
North..	8 "	Payne Avenue	Tee in Dayton to Tee in Clifton	310		
North	8 "	Payne Avenue	Tee in Willson Avenue to Tee in Willard	625		
South..	8 "	Superior	40 East of Dunham Avenue, east	649	5,175	Total 8 in. pipe.
East	6 "	Arlington	Tee in Garden, south	507		
West	6 "	Cross	Tee in Fourth north to Connect Pipe	151		
East	6 "	Clifton	S. L. St. Clair, south.	266		
East	6 "	Dayton.	N. L. Kelley to Tee in Payne	560		
East	6 "	Florence	N. L. Woodland, north.	6		
East	6 "	Guernsey..	S. L. Lorain, south	6		
South	6 "	Howard	Tee in Scranton, west	32		

SCHEDULE SHOWING THE EXTENSION OF WATER PIPE IN 1878.—CONTINUED.

SIDE.	SIZE.	STREET.	BETWEEN WHAT POINTS	FEET TOTAL.	REMARKS.
West	6 "	Harkness	N. L. Euclid, north	1,741	
East	6 "	Henry	N. L. Woodland to Tee in Scovill	980	
East	6 "	Hackman	Tee in Scovill to Hydrant at Garden	1,127	
East	6 "	Jersey	E. L. Fulton to Tee in Jay	146	
West	6 "	Jennings	Hydrant at Jerry to Connect Pipe at Starkweather	1,510	
North	6 "	Jefferson	Cross in University to Cross in Professor	530	
South	6 "	Kelley	Tee in Buckeye to E. L. Buckeye	24	
East	6 "	Lawrence	Tee in Lake to Cross in King	351	
South	6 "	Lake	Tee in Lawrence to W. L. Lawrence	30	
East	6 "	Liberty	S. L. Franklin, south	723	
West	6 "	Morse	S. L. Euclid, south	6	
East	6 "	Madison Avenue	S. L. Home to Hydrant north of Hough	1,123	
South	6 "	Mason	Tee in Willson Avenue to Tee in Willard	420	
South	6 "	Ohio	70 E. of N. L. Woodland to W. L. Erie	426	
East	6 "	Putnam	N. L. Woodland to Cross in Scovill	10,313	
West	6 "	Professor	Cross in Jefferson to Cross in College	1,158	

## SCHEDULE SHOWING THE EXTENSION OF WATER PIPE IN 1878 - CONTINUED.

SIDE.	SIZE.	STREET.	BETWEEN WHAT POINTS.	FEET LAID.	TOTAL.	REMARKS.
East.....	6 "	Richland.....	Tee in Quincy, north.....	54		
North.....	6 "	Viaduct.....	Tee in Tyler Alley, east.....	20		
North.....	6 "	Woodbine.....	Tee at Harbor to W. L. Fulton.....	1,775		
South.....	6 "	Whitman.....	W. L. Kentucky to Y in Woodbine.....	611		
East.....	6 "	Willard.....	N. L. Chatham to Sprinkler near Lorain.....	638		
East.....	6 "	Willard.....	Tee in Payne to Tee in Mason.....	1,432		
East.....	6 "	Ward.....	From Tee Monroe to 31 S. of Lorain.....	1,126		
East.....	6 "	York.....	Cross in Jay to S. L. Vestry.....	237	18,225	Total 6 in. Pipe.
East.....	4 "	Bond.....	S. L. St. Clair to 55 N. of Rockwell.....	205		Relaid.
East.....	4 "	Buckeye.....	Tee in Payne to Tee in Kelley.....	563		
East.....	4 "	Clifton.....	Tee in Payne to S. L. Payne.....	45		
North.....	4 "	Fourth.....	Hydrant at Commercial to Tee in Cross.....	506		
East.....	4 "	Glendale.....	Tee in Cedar, south.....	562		
North.....	4 "	Jay.....	Tee in Jersey to E. L. Jersey.....	26		
South.....	4 "	Lake.....	Tee in Canfield, west.....	318		
South.....	4 "	King.....	Cross in Lawrence to E. L. Lawrence.....	30		

SCHEDULE SHOWING THE EXTENSION OF WATER PIPE IN 1878.—CONTINUED.

SIDE.	SIZE.	STREET.	BETWEEN WHAT POINTS.	FEET LAID.	TOTAL.	REMARKS.
North.....	4 inch.	Mulberry.....	Tee in Pearl to Cross in Spruce.....	463		
South.....	4 "	Sumner.....	E. L. Erie to Tee in Brownell.....	1,150		
South.....	4 "	St. Clair.....	Hydrant E. of Courtland, east.....	157		
North.....	4 "	Viaduct.....	Tee in Tyler Alley, west.....	231		
North.....	4 "	Washington.....	Tee in Center, West.....	330		
East.....	4 "	Waring.....	S. L. St. Clair to Rd. at Superior.....	850		
	4 "	Hydrant Connections.....		500	6,110	Total 4 in. Pipe.
South.....	3 "	Superior.....	From Eastern Con. to Sprinkler Op. Forest City House.....	38	38	Total 3 in. Pipe.
Total Feet of Pipe Laid in 1878.....					29,548	



SCHEDULE SHOWING SIZE, NUMBER AND LOCATION OF STOP  
GATES SET IN 1878.

No.	SIZE.	STREET.	SIDE.	LINE OF STREET.
1	8 inch.	Clark Avenue .....	South,	W. L. Burton.
1	8 "	Cedar Avenue .....	"	2 East of Hydrant at C. & P. R. R.
1	8 "	Cedar Avenue .....	"	W. L. Harnet.
1	8 "	Detroit .....	"	W. L. Gordon Avenue.
1	8 "	Detroit .....	"	5 E. of City Limits.
1	8 "	Gordon Avenue .....	East,	N. L. Detroit.
1	8 "	Gordon Avenue .....	"	S. L. Detroit.
1	8 "	Payne Avenue. ....	North,	W. L. Willson Avenue.
8	.....	Total 8 inch valves set in 1878.		
1	6 inch.	Arlington .....	East,	S. L. Garden
1	6 "	Curtiss .....	South,	E. L. Willson.
1	6 "	Dayton .....	East,	S. L. Payne.
1	6 "	Florence .....	"	N. L. Woodland.
1	6 "	Howard .....	South,	W. L. Scranton.
1	6 "	Henry .....	East,	S. L. Scovill.
1	6 "	Hackman .....	"	N. L. Scovill.
1	6 "	Harkness .....	West,	2 ft. N. of Sec. Hydrant N. of Euclid
1	6 "	Jennings .....	"	N. L. Branch.
1	6 "	Jennings .....	"	N. L. Jerry.
1	6 "	Jefferson .....	North,	W. L. University.
1	6 "	Jefferson .....	"	E. L. Professor.
1	6 "	Liberty .....	East,	S. L. Franklin.
1	6 "	Lawrence .....	"	N. L. Lake.
1	6 "	Mason .....	South,	W. L. Willson Avenue.
1	6 "	Madison .....	East,	S. L. Home.
1	6 "	Madison .....	"	S. L. Hough.
1	6 "	Professor .....	West,	N. L. Jefferson.

**SCHEDULE SHOWING THE SIZE, NUMBER AND LOCATION OF  
STOP GATES SET IN 1878.—CONTINUED.**

No.	SIZE.	STREET.	SIDE.	LINE OF STREET.
1	6 inch.	Putnam.....	East,	S. Scovill.
1	6 "	Richland.....	"	N. L. Quincy.
1	6 "	Ward.....	"	N. L. Monroe.
1	6 "	Willard.....	"	S. L. Payne Avenue.
1	6 "	Willard.....	"	N. L. Mason.
1	6 "	Woodbine.....	North,	E. L. Harbor.
1	6 "	Woodbine.....	"	W. L. Kentucky from the South.
1	6 "	Whitman.....	South,	S. L. Woodbine.
1	6 "	York.....	East,	N. L. Jay.
27	Total number of 6 inch valves set in 1878.			
1	4 inch.	Buckeye.....	East,	S. L. Payne.
1	4 "	Fourth.....	North,	W. L. Cross.
1	4 "	Glendale.....	East,	S. L. Cedar.
1	4 "	King.....	South,	E. L. Lawrence.
1	4 "	Lake.....	"	W. L. Canfield.
1	4 "	Mulberry.....	North,	W. L. Spruce.
1	4 "	Mulberry.....	"	W. L. Hemlock.
1	4 "	Sumner.....	South,	W. L. Brownell.
1	4 "	Washington.....	East,	W. L. Center.
1	4 "	Waring.....	"	N. L. Superior.
56	4 "	Valves for Hydrant connections.		
66	Total number of 4 inch valves set in 1878.			
1	3 inch.	Superior.....	South,	14 ft. E. of E. Curb Op. F. C. House.
102	Valves of all sizes set in 1878.			



## RECAPITULATION OF STOP GATES.

	36	30	24	20	16	12	10	8	6	4	3
Water Way in Inches .....											
Set previous to 1878 .....	1	14	7	14	19	15	90	144	498	799	979
Set in 1878 .....								8	27	66	1
Total in use .....	1	14	7	14	19	15	90	152	520	865	1,957

## SCHEDULE SHOWING THE LOCATION OF FIRE HYDRANTS SET IN 1878.

NO.	SIZE.	STREET.	FEET.	LOCATION.	SIDE.
1	4 in.	Arlington.....	507	S. of Garden.....	East.
2	4 "	Buckeye.....	142	S. of Payne Avenue.....	East.
3	4 "	Cedar Avenue.....	282	E. of Willson Avenue.....	South.
4	4 "	" ".....	12	W. of C. & P. R. R.....	South.
5	4 "	" ".....	130	W. of Glendale.....	South.
6	4 "	" ".....		W. L. Harnet.....	South.
7	4 "	Dayton.....	202	S. of Payne Avenue.....	East.
8	4 "	Detroit.....	586	W. of Oakland.....	South.
9	4 "	".....	12	E. of Gordon.....	South.
10	4 "	Fourth.....	108	E. of Cross.....	North.
11	4 "	Glendale.....	502	S. of Cedar.....	East.
12	4 "	Harkness Avenue.....	387	N. of Euclid.....	West.
13	4 "	" ".....	820	N. of Euclid.....	West.
14	4 "	" ".....	1271	N. of Euclid.....	West.
15	4 "	" ".....	1741	N. of Euclid.....	West.
16	4 "	Henry.....	389	N. of Woodland.....	East.
17	4 "	".....	142	S. of Scovill.....	East.
18	4 "	Hackman.....	258	N. of Scovill.....	East.
19	4 "	".....	410	S. of Garden.....	East.
20	4 "	Jennings Avenue.....	13	N. of Auburn.....	West.
21	4 "	" ".....	13	N. of Branch Avenue.....	West.
22	4 "	" ".....		S. L. Jerry.....	West.
23	4 "	" ".....	352	N. of Jerry.....	West.
24	4 "	Jefferson.....		E. L. Professor.....	North.
25	4 "	Lawrence.....		S. L. King.....	East.
26	4 "	Liberty.....	352	S. of Franklin.....	East.
27	4 "	".....	723	S. of Franklin.....	East.
28	4 "	Madison Avenue.....	16	N. of Gray.....	East.
29	4 "	" ".....	191	S. of Hough.....	East.
30	4 "	" ".....	202	N. of S. L. Hough.....	East.
31	4 "	Ohio.....	347	W. of Erie.....	South.
32	4 "	Payne Avenue.....		W. L. Kirtland.....	North.
33	4 "	Putnam.....	227	N. of Woodland.....	East.

**SCHEDULE SHOWING THE LOCATION OF FIRE HYDRANTS SET IN  
1878—(CONTINUED.)**

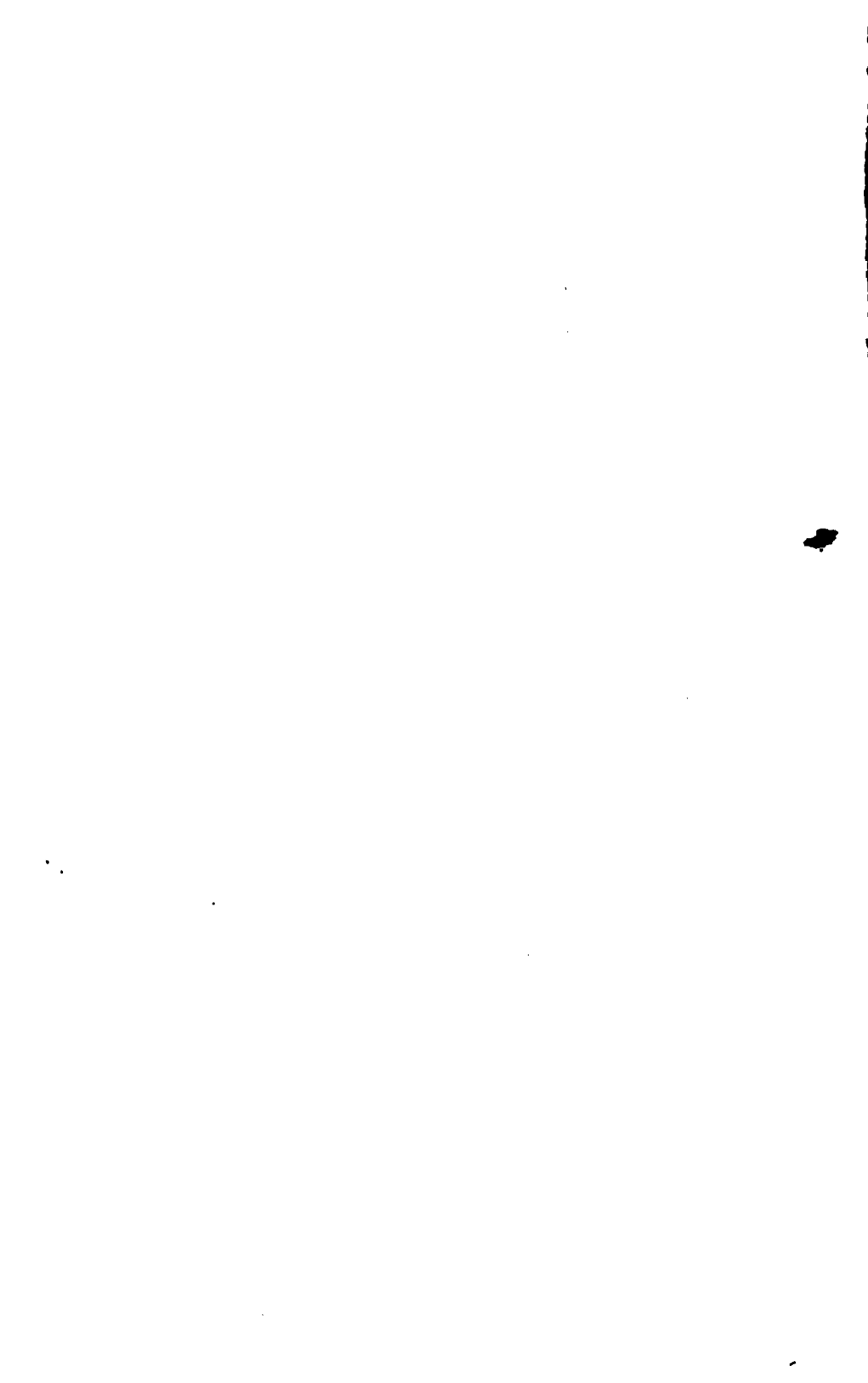
NO.	SIZE.	STREET.	FEET.	LOCATION.	SIDE.
34	4 in	Putnam.....	546	N. of Woodland.....	East.
35	4 "	".....	236	S. of Scovill.....	East.
36	4 "	Sumner.....	224	E. of Erie.....	South.
37	4 "	".....	500	E. of Erie.....	South.
38	4 "	".....	153	W. of Brownell.....	South.
39	4 "	Superior.....	340	E. of Dunham.....	South.
40	4 "	".....	128	W. of Giddings.....	South.
41	4 "	Viaduct.....	231	W. of Tyler Alley.....	North.
42	4 "	Woodbine.....	381	E. of Harbor.....	North.
43	4 "	".....	2	W. of W. L. Kentucky from S.	North.
44	4 "	".....	146	W. of Duane.....	North.
45	4 "	Whitman.....	181	West of Woodbine.....	South.
46	4 "	Willet.....		At Chatham.....	East.
47	4 "	".....	238	S. of Lorain.....	East.
48	4 "	Willard.....	112	S. of Payne Avenue.....	East.
49	4 "	".....	523	S. of Payne Avenue.....	East.
50	4 "	".....	436	N. of Mason.....	East.
51	4 "	".....		At Mason.....	East.
52	4 "	Ward.....	226	S. of Lorain.....	East.
53	4 "	".....	112	S. of Chatham.....	East.
54	4 "	Washington.....		At A. & G. W. R. R.....	North.
55	4 "	Waring.....	145	S. of St. Clair.....	East.
56	4 "	".....	198	N. of Superior.....	East.

56 Set in 1878.

817 Set previous to 1878.

873 Total in use December 31, 1878.





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TWENTY-FOURTH  
ANNUAL REPORT

OF THE  
BOARD  
OF  
**Trustees of Water Works,**  
TO THE  
CITY COUNCIL,  
TOGETHER WITH THE  
REPORTS OF THE OFFICERS OF THE BOARD  
For the Year 1879.

CLEVELAND, O.:  
WISEMAN & HARVEY, PRINTERS.  
1880.

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. M. SOC. CIVIL ENGINEERS



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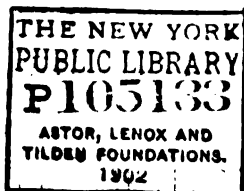
For the Year 1879.

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# REPORT

OF

## Trustees of Water Works.

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*To the Honorable Mayor and Council of the City of Cleveland:*

GENTLEMEN :—The undersigned herewith submit the Twenty-fourth Annual Report of the Secretary, the Superintendent and Engineer, and the engineer in charge of the Pumping Works of the City Water Works Department, and respectfully ask for them your closest scrutiny.

Being so full and complete in detail and timely suggestions, we can do no better than ask a careful perusal of the same for your information as to the present condition of the department and its immediate and future needs.

We would, however, call your special attention to the increase of water consumption the past year, and the need of immediate steps being taken to enlarge the pumping capacity and main and distribution pipes, as recommended by the Superintendent and Engineer in his report.

The unprecedented and suddenly increased demand for water throughout the city the past year, and especially among the manufacturing interests, has changed the whole aspect from one year ago so materially, that what seemed adequate then, now appears to be far from it.

We then anticipated, judging from the four or five years past, that the annual increase of water consumption would not average to exceed five per cent., and the pumping capacity

would be quite sufficient for several years to come; but, with the general revival of business and employment of labor, the increase has reached nearly twenty (20) per cent. the past year, and we anticipate that the year 1880 will make equal demands upon the department.

While this is a matter of congratulation in the minds of all good citizens, it must necessarily bring greater demands upon the department, involving large outlays of money, in order to meet the emergency, so large that all of the revenue from the department will be absorbed in the necessary outlays for at least two or three years to come, and we trust that in making these outlays the department may exercise the same wise and judicious judgment as its record shows for the past.

We believe the department to be in its usual good condition. Its collections are up closer than ever before. Officers of the department unchanged and faithfully performing their duties. The details and suggestions in the Superintendent's report should not be passed unnoticed. They call for action, and your cordial co-operation is desired.

Respectfully submitted,

TRUMAN DUNHAM,

N. P. BOWLER,

S. W. SESSIONS,

*Trustees of Water Works.*

Cleveland, O., March 9th, 1880.

## SECRETARY'S REPORT.

---

*To the Trustees of Water Works :*

GENTLEMEN :—In accordance with law I respectfully submit the following report for the year 1879 :

The receipts for water including permits less	
amount refunded is	\$182,173 33
The amount of net expenses and repairs is	55,799 20
	<hr/>
Leaving the net earnings	\$126,374 13

The receipts for water are in excess of the previous year, the sum of twenty-two thousand forty-seven dollars and sixty-three cents, being the largest increase of any year. This large increase, due mainly to a general revival of business, will not probably be realized in the year 1880, but the receipts may safely be estimated at one hundred and ninety thousand dollars, and the ordinary expenses and repairs at fifty-six thousand dollars. An approximate statement for 1880 may be made that

The receipts for water will be	\$190,000 00
Cash balance in city treasury may be reduced	26,000 00
	<hr/>
Total amount available for all purposes	\$216,000 00

Of this amount there will be required

For interest	\$60,000 00
For expenses and repairs	56,000 00
	<hr/>
Leaving available for other purposes	\$100,000 00

The receipts and disbursements for the year 1879, and balance of cash as shown by the ledger accounts, are as follows :

## RECEIPTS.

For water from assessments.....	\$ 120,865 02
" " " meter measure.....	59,005 06
For permits .....	2,502 00
On Construction Account.....	420 00
On Interest .....	60 67
On Pipe Extension .....	1,633 73
On Water Meter .....	15 25
On Office and General Expense Account .....	463 60
On General Repairs Account.....	298 58
On Engine House Repairs Account.....	576 60
<b>Total receipts .....</b>	<b>\$ 185,840 60</b>
Cash in office January 1, 1879.....	1,351 95
Cash in City Treasury January 1, 1879.....	31,159 31
	<b>\$ 218,351 86</b>

## DISBURSEMENTS.

For interest on Water Works Bonds. ....	\$ 50,000 00
" " contract.....	304 53
For pipe extension .....	42,714 86
For engine house expenses.....	24,807 14
For office and general expenses.....	20,273 06
For general repairs .....	7,939 53
For repairs at engine house.....	2,971 30
For repairs lake tunnel crib .....	1,147 05
For water rents refunded .....	198 75
For lake crib super-structure .....	12,780 65
For final payment on new boiler account.....	1,036 11
For payment on Construction account.....	722 22
For payment on Lake Crib Protection account.....	1,122 70
For water meters .....	3,834 74
<b>Total disbursements .....</b>	<b>\$ 169,852 63</b>
Cash in office January 1, 1880.....	751 91
Cash in City Treasury subject to draft January 1, 1880.....	47,747 32
	<b>\$ 218,351 86</b>

For a detailed statement of the disbursements, as certified to the City Auditor for payment, reference is made to the exhibit accompanying the report of the Superintendent and Engineer.

The items of receipts other than for water and permits are :

Interest on cash item city certificate of \$1200.....	\$ 1 47
Rent of room in Cushing Block.....	80 00
Cleveland Rubber Works, 287 lbs old rubber, at 3 cts.....	8 61
E. M. McGillen & Co., labor and material putting in ele- } \$ 11 75	
vator connection.....	50 95
E. M. McGillen & Co., labor.....	2 90
C. Whittaker, labor and material putting in connection for elevator	77 88
B. P. Bower, labor and material putting in connection for elevator	
W. C. Scofield.....	90 23
Interest on judgment in Court of Common Pleas.....	59 20
Jas. Farnan, estimate for 3,156 lbs old brass, at 18 cts .....	568 08
Taylor & Kilpatrick, labor and material putting in connection for	
elevator.....	51 78
John Varner, for three old boilers.....	420 00
O. A. Childs, for water meter.....	15 25
D. McClosky, labor and material putting in connection for elevator	77 49
Lake Shore Foundry, scrap iron, 16,000 lbs at \$14.00.....	112 00
Lake Shore Foundry, scrap iron, 45,630 lbs at \$12.50 .....	285 18
Forest City House, labor and material putting in connection for	
elevator.....	46 20
Geo. A. Stanley, labor and material putting in connection.....	8 52
Woodland Avenue Cemetery, labor and material putting in con-	
nection.....	19 06
Catholic Cemetery, Woodland Ave., labor and material putting in	
connection.....	13 78
Cleveland Saw Mill Co., valve box, &c.....	12 20
H. J. Reedy, labor and material for 3 connections for elevators ...	259 29
City of Erie, use of water meter.....	5 00
Smith & Connors, 374 lbs 8 inch pipe, at 1¼ cts.....	5 61
Rocky River R. R. Co., labor and material putting in 2 in. connect'ns	
Bridge St.....	32 97
Griswold & Dunham, for pipe laying in French street.....	254 83
C & P. R. R. Co., for fire hydrant and labor setting same.....	49 80
C & P. R. R. Co., repairing fire hydrant.....	15 50
O. G. Kent, removing fire hydrant.....	19 12
For old cement pipe sold. ....	50
C. C. C. & I. Ry. Co., repairing fire hydrant.....	4 25
I. Sturtevant & Co., labor and material putting in connection for	
fire purposes.....	34 46
Jewish Orphan Asylum, labor and material putting in 2 in. connec'ns	17 31
For old pipe sold from Reservoir.....	12 50

## REPORT OF TRUSTEES OF WATER WORKS.

Smith & Connor, repairing hydrant at Union Passenger Depot .....	2 50
Willcox, Treadway & Co., labor and material putting in fire hydrant .....	50 73
Rent of rooms in Cushing Block .....	298 00
T. Manning, 5,560 lbs scrap iron.....	88 80
Hickox & Co., repairing valve .....	7 50
Rent of rooms in Cushing Block .....	80 00
Lake Shore Foundry, scrap iron, 21,380 at \$12.50, \$183.62; 6,910 lbs at \$15.00, \$51.82.....	185 44
Woods, Perry & Co., damage to fire hydrants.....	12 36
Village of West Cleveland, 3 feet of 8 pipe .....	2 25
Warrants on City Treasurer canceled before payment .....	2 80
	<b>\$ 3,468 52</b>

## LEDGER BALANCE JANUARY 1, 1880.

## FACE OF LEDGER.

Construction Account .....	\$2,529,301 44	
Interest.....	81,984 59	
Water Meters. ....	14,668 17	
City Treasurer .....	47,747 32	
Cash.....	751 91	
Bonds outstanding.....		\$1,375,000 00
Bonds redeemed.....		450,000 00
Water Rent, net income .....		900,979 83
City of Cleveland.....		48,473 60
	<b>\$2,674,453 43</b>	<b>\$2,674,453 43</b>

The bonded debt of the city for Water Works purposes has been reduced during the year the sum of twenty-five thousand dollars, payment being made from the sinking fund, leaving outstanding as shown above, twelve hundred and seventy-five thousand dollars.

The abundance of money in circulation enabled consumers of lake water to pay the bills due in October more promptly and with less complaint than for some time past.

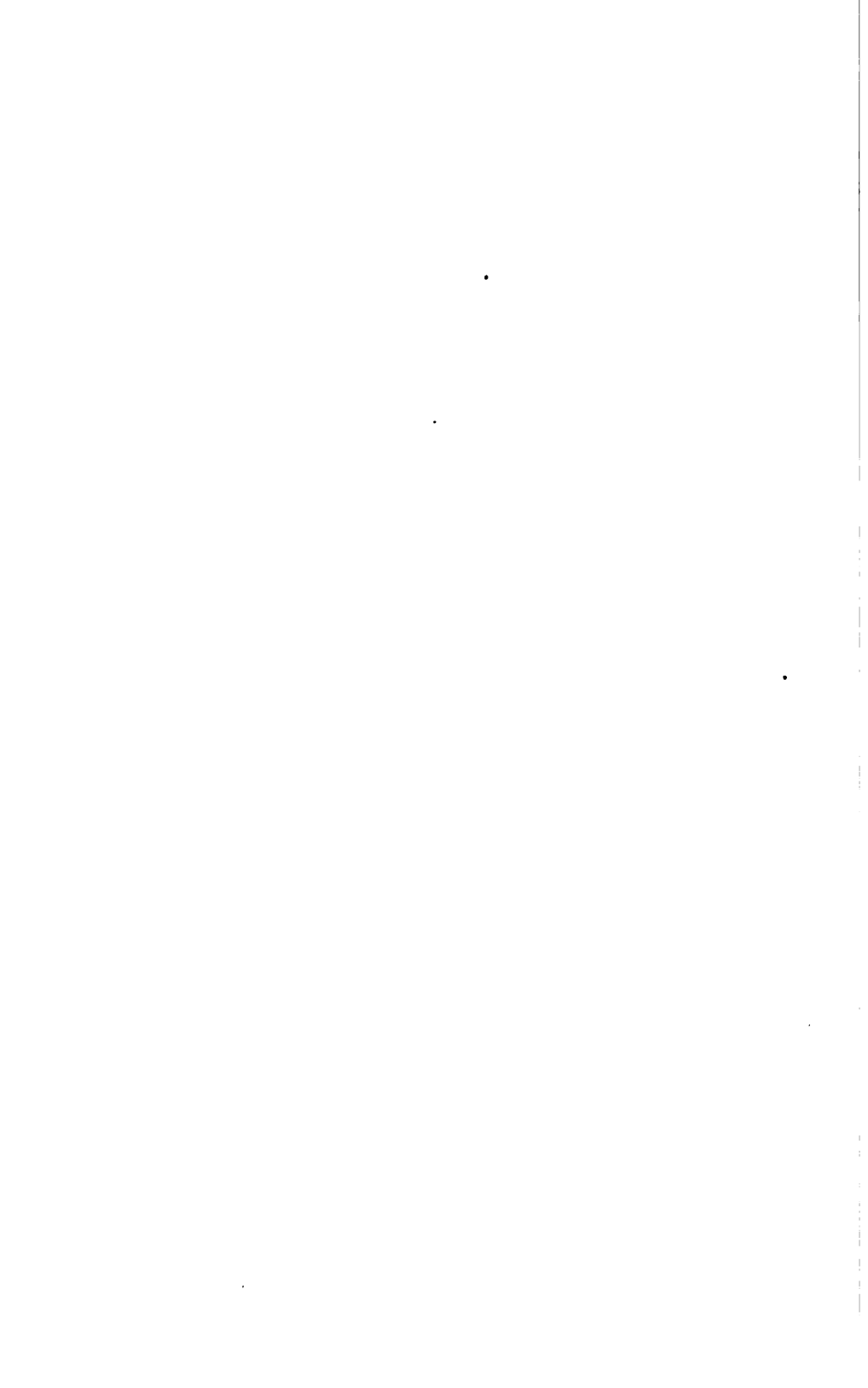
The October bills unpaid and remaining off at the close of the year amounts to \$1,220 76 ; unpaid and not turned off, \$383 60. A large portion of the last sum has since been paid.

H. C. HAWKINS,

*Secretary.*

March, 1st, 1880.





REPORT OF THE

Superintendent and Engineer.

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*To the Board of Trustees of Water Works :*

GENTLEMEN :—The twenty-fourth annual report of your Superintendent and Engineer is herewith respectfully submitted.

LAKE CRIB.

This structure passed through the winter without receiving any serious injury, the only damage done being the tearing off of a portion of the outer planking on the north wall. On the evening of August 26th, the lamp room in the light tower took fire, it is supposed, from the explosion of the lamp used in the lighthouse, the wood work was entirely consumed, and the iron sheeting badly warped. The repairs made are temporary, but of a character to serve the purpose until such time as the structure itself is repaired permanently. During the summer a wrought iron band, three feet deep and five-eighths of an inch thick, was put around the timber substructure below the water line, so that the top is just above the base of the masonry. Nothing has been done up to this time to repair the damage caused by the storm of September, 1878, and should no further disturbance of the masonry take place before the damage is repaired, only a small proportion of that now standing would have to be reset, should it be decided to restore the building to its original form. If it is decided to rebuild the material

now standing can be used again. The experience gained from observing the action of storms and ice during another fall and winter, will aid you in forming a better judgment as to the requirements of such a structure. The consideration of the subject will, doubtless, receive your earnest attention at an early day.

#### TUNNEL.

The tunnel has not required any care during the year, the flow of water has, as heretofore, been uninterrupted, and the quality of the water during the year has been good. Some of the rip rap stone thrown around the outside of the crib, had either fallen, or been washed into, one of the inlets; these were removed by Captain Breyman during the time he was engaged in fastening on the iron band, mentioned above.

#### BUILDINGS AND MACHINERY.

An inspection of the wood work casing of the standpipe was made during the summer, when it was found that the railing and platform at the top of the tower were in an unsafe condition; these have been removed, the wood work has been covered with tin and the whole work thoroughly painted. The winding stairway leading to the top of the tower is badly worn and should be renewed at an early day.

The joints of the iron roof of the south building have been calked with iron ore putty wherever necessary, and made water tight.

No other repairs to the buildings have been necessary during the year. After the awarding of the last contract for the season's supply of coal, the Atlantic & Great Western Railway Company extended their river bed track into the engine house grounds, thus enabling the coal contractor to deliver coal on the track inside of the grounds, from whence it is taken in small coal cars directly into the boiler rooms. During the fall a number of small leaks occurred in the pumping mains under

the lawn in the south lot, making it necessary to disturb the sodding in several places, the relaying of which, owing to the lateness of the season, cannot be done until spring. A new 30-inch check valve has been put in the pumping main, leading from the Henderson engine; at the same time this was being done a 30-inch branch pipe was put in the same line just outside of the check valve, having attached thereto a 30-inch screw valve. This work was done in anticipation of the early extension of a new pumping main, from the pumping works to the central part of the city. This office is now connected by wires with the pumping works and with the Telephone Exchange, enabling prompt and rapid communication between the two places, as well as with other patrons of the exchange.

The information contained in the report of Mr. Doty, the chief engineer, in charge of the pumping works, regarding the condition of the several engines and boilers, shows the machinery and other parts of the works, under his immediate care, to be in good order, and he is enabled to report that no serious accident has occurred to any of the machinery during the year.

#### RESERVOIR.

The usual repairs to the brick paving of the inner slopes of the reservoir, at and near the water line, were made during the early part of the season. The deposit of sediment was so small that it was not considered necessary to clean the basins. The grass on the south and west slopes of the embankment is not in as good condition as on the other sides; with the usual spring rains it will, no doubt, revive in due season. All the other parts of the grounds, as well as the fences and railings, are in good condition,

#### MAIN PIPES.

No leaks, other than the slipping of lead in the joints, have occurred in either of the pumping mains during the year; but two very serious leaks were developed in the 16-inch wrought

iron, cement lined, distributing main, the first of which was in Erie street, and appeared to be a general rupture of the pipe between Ohio and Huron streets, a distance of about 1,300 feet. Throughout this distance water appeared at nearly the same time in a number of places between these points. These leaks, appearing as they did during a very severe thunder storm, would seem to indicate that the pipe may have been injured by lightning. A similar case was noted in an Eastern city two years ago.

Cast iron pipe has been laid to take the place of the pipe thus injured. The other break occurred on the morning of the 29th of December, near the top of Franklin street hill, washing a hole in the street 20 feet deep and fifty feet long, flooding the lots and premises below between Franklin and West River streets, and destroying a large amount of household and other property. The amount of damage will probably reach \$2,500. The leak was, doubtless, caused by the gradual settlement of the hillside in which the pipe is laid. This pipe is a part of the same line laid in Erie street, and is of the same kind; it has been relaid with cast iron for a distance of 235 feet. The entire line from Columbus street to Pearl street should be relaid in the same manner at once.

#### DISTRIBUTING PIPES.

The length of distributing pipe laid during the year was eight miles and 743 feet, of which one mile and 152 feet was laid to take the place of abandoned pipe, leaving the net increase seven miles and 591 feet. The total length of pipe now in use of all sizes is 120 miles and 3,261 feet, nine miles and 897 feet being main pipes from sixteen to thirty-six inches diameter.

The number of stop gates added was 152, which, with the number heretofore in use, makes a total of 2,109.

Of fire hydrants there were added to those in use one year ago 91, making a total number at this date of 964, all of which are in good order. For information in detail see following tables.

## SERVICE PIPES.

The number of new service pipe connections made during the year was 833, being 230 more than were made during 1878. The number of each size is as follows :

4 inch	-	-	-	-	-	-	-	8
3 "	-	-	-	-	-	-	-	3
2½ "	-	-	-	-	-	-	-	1
2 "	-	-	-	-	-	-	-	7
1 "	-	-	-	-	-	-	-	4
¾ "	-	-	-	-	-	-	-	12
½ "	-	-	-	-	-	-	-	798
<hr/>								
Total	-	-	-	-	-	-	-	833

The total number of service connections made since the construction of the works and the number of each size is as follows :

6 inch	-	-	-	-	-	-	-	1
4 "	-	-	-	-	-	-	-	38
3 "	-	-	-	-	-	-	-	34
2½ "	-	-	-	-	-	-	-	2
2 "	-	-	-	-	-	-	-	69
1½ "	-	-	-	-	-	-	-	21
1¼ "	-	-	-	-	-	-	-	3
1 "	-	-	-	-	-	-	-	108
¾ "	-	-	-	-	-	-	-	384
½ "	-	-	-	-	-	-	-	10,215
<hr/>								
Total	-	-	-	-	-	-	-	10,875

Of this number 9,285 are in use ; the remainder are either shut off or abandoned. The increase in the number of service pipes in use is 901, being 277 more than the increase in 1878.

## METERS.

The number of meters in use on the 31st day of December was 358. Of this number 67 were set during the past year. The different sizes, the number of each size and description of meter is as follows :

3	-	4	inch	-	Worthington	Piston	Meters.
19	-	3	"	-	"	"	"
41	-	2	"	-	"	"	"
42	-	1½	"	-	"	"	"
71	-	1	"	-	"	"	"
77	-	¾	"	-	"	"	"
2	-	3	"	-	Ball & Fitts	Rotary	"
1	-	¾	"	-	"	"	"
4	-	1½	"	-	"	Piston	"
44	-	1	"	-	"	"	"
54	-	¾	"	-	"	"	"

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Total, 358

There are also 31 hydraulic elevators, to each one of which is attached an indicator that records the quantity of water used. The village of West Cleveland, which is supplied from these works, owns an 8 inch meter, through which the water passes to that corporation. This meter is not counted in the above list, but the quantity of water passing through it is included in the quantity of water measured, which for the year amounted to 470,913,872 gallons.

## DISTRIBUTION.

During the year 3,455,271,981 gallons of water were pumped, being an increase over the quantity pumped in 1878 of \$562,325,158 gallons, or a daily increase in consumption over the preceding year of 1,540,616 gallons, equal to an increase

for the year of 19.43 per cent., the increase for 1878 being only 2.57 per cent. It will be seen by referring to the following tables that the increase for the past year is greater than for any year since 1872. During the hot summer weather the maximum quantity pumped through a portion of each day frequently reached a rate equal to 16,000,000 gallons in 24 hours, a quantity equal to four-sevenths of the entire pumping capacity of the machinery. Assuming that the increase during the coming year will equal that of 1879, the maximum quantity that will be required during a portion of the season will reach a rate of nearly 20,000,000 gallons in 24 hours. It is, therefore, not unlikely that during the coming year the demand may reach five-sevenths of the entire capacity of the works, leaving a margin far too small under a direct supply system, such as ours now is. With a large storage reservoir, the capacity of the machinery need but be little in excess of the average demand, but, under a system like ours, the power in reserve should be nearly, if not quite, equal to that in use. You will, therefore, see the necessity of taking immediate steps to procure additional pumping machinery. Anticipating early action on your part, plans have been made for a new boiler house north of the old pumping house, the proposition being to use the present boiler rooms of the old house for the new engines. By this arrangement all the engines on the north lot will be in one building and the boilers in a building in the rear. The estimated cost of this enlargement, including new boiler house and chimney, three new boilers, one ten million gallon pumping engine, aqueduct and pump well, and new 30 inch pumping main from the engine to the central part of the city is \$250,000. This work need not be all completed during the coming year, but should all be commenced. The new pumping main, however, should be laid and connected with the north engine in the new pumping house as early as possible during the present year, so that both engines in the south building



may be run at the same time and deliver water through separate pipes.

The increased demand for water has been so rapid and unexpected that only a short time can be allowed in which to make the enlargement.

The cost of pumping each million gallons of water 100 feet high, during the past year, was \$5 00; in 1878 the cost was \$5 49, while for 1877 the cost of doing the same work was \$6 02. This cost includes every expenditure, of whatever nature made at the pumping works during the year, and the showing for 1879 is believed to be, and is so far as can be ascertained from any reports received at this office, the lowest in the country. The increase in the use of water as a motive power for elevators and other light machinery makes it necessary to increase the size of pipes in the business sections of the city. Last year an 8 inch pipe was laid in a portion of Water street, which, during the coming year, should be extended from Superior street to Lake street, to accommodate those persons wishing to place elevators in their blocks, as well as to add to the power of those already in use.

An 8 inch pipe should also be laid in River street, from Superior street to St. Clair street, and from Maine street to Front street. This pipe is necessary to accommodate the increasing demand for water from the railroads and manufactories in the district supplied by the small pipe now in use. With a general revival of business, the demand for water pipe to be laid during the coming year will probably equal, if it does not exceed, that of last year.

The surplus funds of the department, available for extension or enlargement, are estimated by the Secretary to be about \$100,000, which sum is very near the estimated cost of the main pipe referred to above. Should any distributing pipe be laid, it will be necessary to make application to the City Council

for funds with which to make up the enlargement contemplated. The necessity for this work has been of sudden growth, and must be provided for without delay.

Respectfully submitted,

JOHN WHITELAW,

*Superintendent and Engineer.*

Cleveland, February 18th, 1880.



## REPORT OF THE

### **Engineer in Charge of the Pumping Works.**

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*To the Board of Trustees of Water Works:*

GENTLEMEN :—At the close of 1878 the work of putting in the last two of the four marine boilers was not quite completed. This work was continued with the utmost diligence until February 6th, when the boilers were ready for service. Since that date all the boilers in the south building have been constantly ready for use, and at this time all the boilers at the works are in good working order. April 1st we commenced removing the old boilers from the west boiler room of the north building, as recommended in my report of 1878, to make room for the boilers taken from the south building. Subsequent examination proved that the change was made none too soon, as twenty-two years of constant use had rendered them unfit for longer service. The setting of these boilers was completed May 20th. In connection with this work it was found necessary to repair and put in order all the stop valves, expansion joints and pipes connecting the boilers with each other, and also connecting them with the engines, as they all showed the effect of long service. It was also thought best to adopt a new steam pipe system, in order to be better able to meet the emergencies which are liable to occur with our present water supply system. The new arrangement makes it possible to run either engine with either battery of boilers.

Should the engine in operation become disabled we are now prepared to start the other immediately, without the delay

heretofore necessary in firing up the other battery of boilers, a very complete and satisfactory arrangement. No change has been made in the east battery of Cornish boilers, but with the new arrangement of steam pipes we are not very largely dependent upon them, excepting when necessary to run both engines.

All the steam pipe and stop valves connecting the new Cornish boilers with the engines have been covered with a non-conducting cement or plaster, which reduces the loss from radiation and condensation to a mere nominal quantity. The other three boilers removed from the south building still remain in the north side yard, and plans are maturing for putting them into service, which will doubtless be brought to your notice by the Superintendent at an early day. No extensive repairs have been necessary upon any of the engines or pumps since my last report, and at this time they are all in good working order.

Amount of repairs upon each engine for 1879 :

Worthington Duplex Engine	.	.	.	\$133 33
Cuyahoga	"	.	.	41 79
East Cornish	"	.	.	29 88
West Cornish	"	.	.	4 20

This statement embraces only bills paid out. Much other work has been done at the works with our own help, the expense of which will appear in the general running expense account of the Secretary.

#### GENERAL STATEMENT.

No accident of any moment has occurred since my last report. This very desirable state of affairs has been largely contributed to by the faithful services of the employes at the works, and it is a very pleasant duty for me to bring this fact to your notice. In this report no special reference is necessary, as all have diligently tried to do their duty.

## NEW PUMPING MACHINERY.

The unparalleled increase in consumption of water (as will be seen by referring to the annexed tables) has forced upon us the fact that steps should be immediately taken to increase the pumping capacity of the works.

When the present circumstances are carefully considered, you will be able to see, I think, the force of this suggestion. Our water supply system has changed from the reservoir or storage system, to the direct supply system, in other words, we are now obliged to pump the water as it is used, and you will at once see the necessity of being supplied with machinery which has sufficient capacity to meet the demands incident to this peculiar system. We are now forced to pump during 15 hours of the day, in certain seasons of the year, at the rate of 16,000,000 gallons in 24 hours, with machinery in use only calculated to pump 14,000,000 gallons in that time. It is plain therefore that we may not be able at all times to give the city a satisfactory pressure.

I have only attempted here to give you some idea of the necessities which prompted me to call your attention to this fast approaching demand, and would respectfully refer you to the report of the Superintendent for further information upon this subject.

A comprehensive tabular statement of the performance of each engine is herewith annexed, to which your attention is invited.

Most respectfully submitted,

R. DOTY,

*Engineer in charge of Pumping Works.*



## TABULAR STATEMENTS.

The following pages contain tabular statements showing the work of engines, distribution of water, extension and laying of pipes, location and number of stop-gates and hydrants set, abstract of expenditures, &c.





# REPORT OF TRUSTEES OF WATER WORKS.

27

## WORTHINGTON DUPLEX ENGINE RECORD FOR 1879.

MONTHS.	DAYS.	PUMPING.		COAL CONSUMED.		GALLONS OF WATER PUMPED.	HEIGHT IN FEET AND DECIMALS.	DUTY.
		Hours.	Minutes.	Strokes.	Raising Steam.	Pumping.		
January	31	743	10	430,024	2,400	769,400	158.052	45,903,160
February	28	689	45	404,462	5,200	793,000	158.184	41,509,778
March	31	752	20	425,820	5,000	845,600	157.965	43,005,761
April	8	170		83,123		147,500	157.437	46,013,989
May	17	302		219,138	3,000	383,000	157.640	45,241,297
June	29	673	45	392,168		652,400	157.471	49,091,667
July	30	691	40	431,660	3,600	733,300	157.711	47,911,982
August	30	696	55	407,216	2,000	727,100	157.928	45,745,240
September	30	718	50	402,371	3,000	742,100	158.072	44,270,647
October	31	744		421,862	5,000	756,600	158.362	45,472,366
November	30	720		391,306	3,300	755,600	158.824	42,471,347
December	28	625		357,952		696,150	159.637	42,803,314
Totals and Averages	823	7,557	25	4,397,721	32,500	7,971,750	158.024	42,683,359



CORNISH ENGINE RECORD FOR 1870.  
WEST ENGINE.

MONTHS.	Days.	PUMPING.		COAL CONSUMED.		GALLONS OF WATER PUMPED.	HEIGHT IN FEET AND DECIMALS.	DUTY.
		Hours.	Minutes.	Strokes.	Raising Steam.	Pumping.	Total.	
February					12,200		12,200	
March		4	15	1,800	8,400	2,000	10,400	7,375.831
May	4	43	35	23,525	4,800	15,800	20,000	48,456.079
June	16	129	50	68,225	24,400	62,200	86,000	33,332.285
July	23	219	50	123,875	24,800	113,400	138,200	37,900.681
August	13	118	15	58,475	16,000	56,800	73,400	33,794.025
October	25	110	15	95,450	27,600	93,800	121,400	33,371.557
November	7	53	10	23,775	8,200	30,800	39,000	25,984.888
December	26	229		106,425	37,400	123,200	160,000	27,971.134
Totals and averages.	114	908	10	550,550	164,400	498,000	662,400	32,099.585

CORNISH ENGINE RECORD FOR 1879—*Continued.*  
EAST ENGINE.

MONTHS.	DAYS.	PUMPING.		COAL CONSUMED.		GALLONS OF WATER PUMPED.	HEIGHT IN FEET AND DECIMALS.	DUTY.
		Hours.	Minutes.	Strokes.	Raising Steam.	Pumping.		
January.....	25	384	35	198,700	11,200	191,200	158.048	40,535,005
February..	14	110	25	61,725	11,000	59,000	158.440	87,188,319
May .....	12	93		48,600	8,800	47,000	157.900	38,905,998
August.....	10	96	50	52,400	12,400	49,400	158.001	35,983,749
September .....	23	200	10	92,425	27,000	90,000	158.368	33,562,265
November....	17	130	10	62,975	20,400	69,600	158.890	29,848,433
Totals and averages..	101	1025	10	517,825	90,800	508,800	158.274	29,816,204

CORNISH ENGINE RECORD FOR 1879 — *Continued.*  
BOTH ENGINES.

MONTHS.	DAYS.	PUMPING.		COAL CONSUMED.			HEIGHT IN FEET AND DECIMALS.	DUTY.
		Hours.	Minutes.	Strokes.	Raising Steam.	Pumping.		
West Engine.....	114	908	10	500,550	164,400	498,000	158 240	32,090,586
East Engine.....	101	1,025	10	517,825	90,800	506,800	158 274	38,816,204
Totals and Averages.	215	1,933	20	1,018,375	255,200	1,004,800	158 257	34,457,894

ANNUAL REPORT OF TOTALS AND AVERAGES FOR BOTH CORNISH ENGINES FOR EACH YEAR SINCE  
THE CONSTRUCTION OF THE WORKS.

YEARS.	PUMPING.			COAL CONSUMED.			GALLONS OF WATER PUMPED.	AVERAGE HEIGHT IN FEET AND DECIMALS.	DUTY.
	Hours.	Minutes.	Strokes.	Raising Steam.	Pumping.	Total.			
1857.....	1206	25	369,894	226,300	407,325	633,525	127,292,265	156 000	
1858.....	1454	55	446,724	232,060	430,225	662,275	142,155,434	156 533	31,435,225
1859.....	1413	00	623,775	233,060	549,600	782,660	168,224,000	155 927	35,667,262
1860.....	1811	05	818,303	246,750	707,950	708,700	200,220,354	156 466	35,206,903
1861.....	2107	35	1,013,129	255,600	854,150	1,118,750	322,175,022	156 432	37,544,069
1862.....	2247	35	1,162,494	276,846	1,115,127	1,391,178	369,673,062	156 357	34,720,024
1863.....	2560	30	1,310,875	281,903	1,169,418	1,551,221	420,770,575	156 083	35,535,438
1864.....	2848	10	1,483,225	274,744	1,445,568	1,720,362	476,114,225	157 313	36,410,146
1865.....	2971	40	1,611,405	290,960	1,579,559	1,866,500	517,261,005	158 017	36,621,770
1866.....	3321	35	1,829,820	276,800	1,825,410	2,202,200	587,273,220	157 731	35,304,587
1867.....	3870	10	2,106,275	200,200	2,162,400	2,432,600	696,390,275	157 439	37,665,494
1868.....	4503	13	2,394,975	198,100	2,074,600	2,276,700	768,793,975	157 922	44,364,421

## ANNUAL REPORT OF CORNISH ENGINES—Continued.

YEARS.	PUMPING			COAL CONSUMED.			GALLONS OF WATER PUMPED.	AVERAGE HEIGHT IN FEET AND DECIMALS.	DUTY.
	Hours	Minutes	Strokes	Raising Steam.	PUMPING.	Total.			
1869	5673	00	2,800,425	70,000	2,585,000	2,655,000	888,838,455	157.509	44,567,444
1870	6852	20	3,508,500	49,000	3,388,200	3,457,200	1,124,228,500	156.970	43,010,620
1871	8048	35	4,200,500	63,200	4,332,400	4,365,600	1,367,621,100	157.781	41,108,940
1872	10562	57	5,253,485	45,200	5,430,800	5,476,000	1,686,370,865	158.377	40,788,146
1873	12808	50	5,624,625	13,600	6,122,200	6,135,800	1,960,768,835	157.886	40,031,983
1874	11083	05	5,163,325	37,400	5,379,400	5,416,800	1,653,460,060	157.400	40,060,999
1875	651	07	21,415	143,500	389,585	463,065	103,228,049	158.180	27,775,460
1876	3019	40	1,362,428	128,304	1,363,400	1,521,794	437,720,867	156.662	33,120,569
1877	630	55	315,635	122,000	394,600	456,600	101,372,466	158.318	27,625,975
1878	945	30	447,690	190,000	441,800	631,800	143,708,460	157.322	42,842,578
1879	1693	20	1,018,375	255,200	1,004,800	1,260,000	326,866,375	158.257	34,457,864



## REPORT OF TRUSTEES OF WATER WORKS.

SCHEDULE SHOWING THE DISTRIBUTION OF WATER FOR EACH MONTH AND DAY IN THE YEAR 1879

MONTHS	GALLONS OF WATER PUMPED.			GALLONS DISTRIBUTED.		
	Cornish Engine.	Henderson Duplex Engines	Worthington Duplex Engines	Per Month.	Average per day.	Each Inhabitant per day.
January	64,103,700		267,172,880	331,276,580	10,686,341	70.70
February	19,812,725	10,773,973	250,766,440	281,540,138	10,048,362	66.54
March	577,800		264,008,400	264,586,200	8,586,068	56.32
April		183,447,941	51,538,260	234,986,201	7,482,806	51.87
May	23,132,125	130,923,916	135,865,560	289,946,601	9,353,116	61.94
June	21,900,225	15,238,134	243,144,160	280,282,519	9,342,750	61.87
July	30,763,875	19,544,527	267,629,200	338,937,602	10,546,874	69.84
August	35,790,875	20,923,913	252,473,620	308,457,708	9,950,248	65.89
September	27,668,425		249,470,020	279,138,445	9,304,614	61.62
October	30,630,450		261,380,840	292,020,290	9,430,009	62.36
November	27,846,760		242,606,100	270,455,860	9,015,195	59.70
December	33,841,425	48,060,182	221,920,240	265,181,847	9,542,962	63.19
Totals and averages	238,866,375	430,566,586	2,707,967,020	3,455,271,981	9,466,498	62.69
						145.61

**SCHEDULE SHOWING THE TOTAL AND AVERAGE QUANTITIES OF  
WATER PUMPED EACH YEAR SINCE THE CONSTRUCTION  
OF THE WORKS.**

YEARS.	GALLONS DISTRIBUTED.				Per Cent. of Increase.
	Per Year.	Per Day	Each Inhabitant Per Day	Each Consumer Per Day.	
1857.....	127,262,265	348,664	7 75	110 68	.....
1858.....	142,155,434	398,467	8.37	93.44	11.70
1859.....	198,284,090	513,107	11.31	91.27	39.45
1860.....	260,230,354	710,984	14 11	101.57	31.87
1861.....	322,175,022	881,599	16.32	114.50	23.81
1862.....	369,673,062	1,012,794	19.47	120.57	14.74
1863.....	420,790,875	1,152,875	20.97	117.54	12.83
1864.....	476,114,225	1,300,858	21.68	123.89	12.14
1865.....	517,261,006	1,417,153	21.80	122.70	8.64
1866.....	587,372,220	1,609,239	22.35	124.26	13.55
1867.....	696,369,375	1,907,861	23.85	115.98	18.55
1868.....	768,786,975	2,106,265	24.77	116.08	10.40
1869.....	896,936,425	2,462,839	27.36	120.20	16.92
1870.....	1,126,228,500	3,065,558	30.86	113.20	25.28
1871.....	1,367,621,100	3,746,907	35.68	124.90	21.43
1872.....	1,686,370,895	4,607,571	40.07	131.64	22.67
1873.....	1,869,768,835	5,065,230	43.06	137.71	10.85
1874.....	2,060,252,910	5,625,150	45.36	141.10	9.65
1875.....	2,216,775,816	6,073,358	44.00	136.65	8.12
1876.....	2,309,225,403	6,573,220	49.22	131.28	8.23
1877.....	2,820,326,074	7,726,920	55.91	142.24	17.55
1878.....	2,862,946,823	7,925,882	51.13	135.05	2.57
1879.....	3,455,271,981	9,466,498	62.69	145.61	19.43

SCHEDULE SHOWING THE EXTENSION OF PIPE IN 1879.

SIDE.	SIZE.	STREET.	BETWEEN WHAT POINTS.	LAID.	TOTAL.	REMARKS.
West.....	16	Erie.....	From T. In Prospect to N. L. Ohio.....	1369	1369	Relaid
West.....	8	Bolton.....	From S. L. Euclid south.....	6		
East.....	8	Custead.....	From 12 ft. N of Euclid north.....	16		
South.....	8	Clark.....	From W. L. Burton to cross in Ash.....	1594		
West.....	8	Doan.....	From S. L. Euclid south.....	5		
North.....	8	Lorain.....	From W L. Waverly to Gordon.....	1332		
East.....	8	Main.....	From Tee in Center north.....	42		Relaid
North.....	8	Payne.....	From Cross in Case to Cross in McHenry.....	712		
North.....	8	Payne.....	From Cross in Sterling to W. L. Siegel.....	341		
East.....	8	Water.....	From N. L. St. Clair to Frankfort.....	513	4541	
South.....	6	Bridge.....	E. L. Waverly west.....	230		
East.....	6	Birch.....	Franklin to Detroit.....	714		
East.....	6	Belmont.....	Cross in Orange to Clatsen connection at Croton.....	557		
West.....	6	Courtland.....	Cross in Bridge south.....	33		
North.....	6	Carter.....	21 ft. E. of E. angle of abut. of bridge over Carter W.....	354		

SCHEDULE SHOWING THE EXTENSION OF PIPE IN 1879—Continued.

SIDE.	SIZE	STREETS.	BETWEEN WHAT POINTS.	FEET LAID.	TOTAL.	REMARKS.
North.....	6	Chatbam .....	Cross in Willet to Tee in Mechanic.....	517		
North.....	6	Chatham .....	Cross in Penn to Cross in York.....	1039		
South.....	6	Carter.....	End of pipe near Hotchkiss & Gaylord's E to hydrant .....	8		
North.....	6	Chestnut.....	Cross in Mulrison to Tee in Dodge .....	1409		
South.....	6	Canal.....	Across Seneca.....	80		Relaid.
West .....	6	Central Place .....	Tee in Ohio to hydrant at Eagle.....	449		Relaid.
South.....	6	Curtiss.....	Willson to Tee in Olive .....	641		
North.....	6	Chestnut.....	Erie to Cross in Mulrison .....	664		Relaid.
North.....	6	Ensign .....	From Tee in Willson east .....	404		
East.....	6	Forest .....	Tee in Cedar to N. L. Garden.....	995		
East .....	6	Florence.....	Tee in Quincy south.....	413		
East.....	6	Grant.....	Tee in Cedar to N. L. Garden.....	1125		
West.....	6	Harmon.....	S. L. Garden to Cross in Judd.....	258		
East.....	6	Harper.....	Tee in Scovill to S. L. Garden.....	1091		
South.....	6	Harilton.....	Tee in Alabama to Cross in Sterling .....	696		
South.....	6	King.....	Cross in Lawrence to Tee in Wason.....	1005		30 feet relaid.

SCHEDULE SHOWING THE EXTENSION OF PIPE IN 1879—Continued.

SIDE.	SIZE.	STREETS.	BETWEEN WHAT POINTS.	FEET LAID.	TOTAL.
South.....	6	Lexington.....	E. L. Willson east.....	1196	
East.....	6	Lyman .....	From hydrant at N. L. Payne, south.....	683	
East.....	6	Lyman.....	Cross in Superior to hydrant at Payne.....	144	
East.....	6	Laurel.....	S. L. Garden to N. L. Scovill.....	877	
East.....	6	McHenry.....	Cross in Superior to Cross in Payne.....	1522	
East.....	6	Merwin.....	Cross in Center to hydrant at German.....	509	Relaid.
East.....	6	Mechanic.....	S. L. Lorain to Tee in Chatham.....	683	
East.....	6	McLean .....	S. L. Lorain to Tee in Monroe.....	1158	
West.....	6	Merchant.....	N. L. Fairfield north to Connect pipes.....	542	
East.....	6	Mulrson .....	Cross in Hamilton south.....	53	Relaid.
South .....	6	Ohio.....	Tee in Central Place to T in Harrison street.....	51	Relaid.
East.....	6	Putnam .....	S. L. Garden south.....	8	
West.....	6	Rhodes .....	From 35 feet N. of Walton north.....	128	
East.....	6	Slater.....	Tee in Griswold south .....	427	
East.....	6	Sterling .....	Cross in Cedar to Garden .....	718	
East.....	6	Sterling .....	S. L. St. Clair to Cross in Superior.....	835	
East.....	6	Sterling .....	Cross in Superior to Cross in Payne.....	1083	

SCHEDULE SHOWING THE EXTENSION OF PIPE IN 1879—*Continued.*

SIDE.	SIZE.	STREET.	BETWEEN WHAT POINTS.	FEET.	TOTAL.	REMARKS.
East.....	6	Sterling.....	S. L. Scovill to N. L. Woodland.....	1027		
East.....	6	Seelye.....	Tee in Woodland to 16 ft. S. of N. L. Julia.....	1973		
North.....	6	Scovill.....	Tee in Willson to W. L. Slater.....	980		
East.....	6	Seneca.....	Cross in Michigan to Tee in Canal.....	427		Relaid.
East.....	6	St. Paul.....	N. L. Detroit North.....	277		
East.....	6	Spring.....	Tee in St. Clair N. to connect pipes.....	645		
East.....	6	Willett.....	N. L. Chatham to Tee in Chatham.....	28		
East.....	6	Water.....	Between 6 and 8 pipes near N. L. Frankfort.....	18		
East.....	6	Willcutt.....	From 11 ft S. of Woodland to N. L. Beaver.....	728		
South.....	6	White.....	From 340 ft. E. of Willson to 15 ft. E. of W. L. Baker.....	641	31246	Total 6 laid.
West.....	4	Bond.....	N. L. Lake to hydrant at Summit.....	284		
North.....	4	Carroll.....	W. L. Pearl to E. L. York.....	529		Relaid.
South.....	4	Cherry.....	E. L. Perry to Tee in Liberal.....	574		
South.....	4	French.....	Tee in Columbus to Tee in Winter.....	380		
South.....	4	Griswold.....	E. L. Kinsman to Cross in Slater.....	663		
East.....	4	Huntington.....	Tee in Euclid to 645 N. of Euclid.....	664		
West.....	4	Harmon.....	Tee in Scovill to Cross in Judd.....	249		

SCHEDULE SHOWING THE EXTENSION OF PIPE IN 1879—Continued.

SIDE.	SIZE.	STREET.	BETWEEN WHAT POINTS.	FEET.	TOTAL.	REMARKS.
North.....	4	Hamilton.....	E. L. Erie to W. L. Canfield.....	1160		Relaid.
South.....	4	Judd.....	Cross in Harmon to W. L. Harmon.....	19		
North.....	4	Race.....	Tee in Central Place to W. L. Central Place.....	39		Relaid.
	4	88 Hydrant Connections.....		1056	5687	
East.....	3	North Place.....	N. L. Garden North.....	10	10	
					42,983	

SCHEDULE OF PIPE TAKEN UP AND RELAID IN 1879.

DIAMETER OF PIPE TAKEN UP.	DIAMETER OF PIPE RELAID.	STREET.	BETWEEN WHAT POINTS.	FEET.	TOTAL.	REMARKS.
C. 16.....	16	Erie.....	Tee in Prospect to N. L. Ohio.....	1399		
C. 4.....	8	Main.....	Tee in Center north.....	42		
C. 4.....	6	Canal.....	Across Seneca.....	80		
C. 4.....	6	Central Place.....	Tee in Ohio to hydrant at Eagle.....	449		
C. 4.....	6	Chestnut.....	E. L. Erie to Cross in Mulron.....	664		
C. 4.....	4	Carroll.....	Pearl to York.....	823		
C. 4.....	4	Hamilton.....	E. L. Erie to W. L. Canfield.....	1160		
I. 4.....	6	King.....	Tee in Lawrence to E. L. Lawrence.....	30		
I. 4.....	6	Merwin.....	Cross in Center to hydrant at German.....	509		
C. 4.....	6	Mulron.....	Tee in Hamilton south.....	53		
I. 4.....	8	Ohio.....	Tee in Central Place to Tee in Harrison.....	51		
I. 4.....	4	Race.....	Tee in Central Place to W. L. Central Place.....	30		
C. 4.....	6	Seneca.....	Cross in Michigan to Tee in Central Place.....	427	1422	





SCHEDULE SHOWING SIZE, NUMBER AND LOCATION OF STOP  
GATES SET IN 1879.

NO.	SIZE.	STREET.	SIDE.	LINE OF STREET.
1	30 inch	Engine House.....		Check Valve.
1	8 "	Clark Av. ....	South.	East Line of Guage St.
1	8 "	Clark Av. ....	"	East Line of Ash St.
1	8 "	Lorain St. ....	North.	West Line of Alum St.
1	8 "	Lorain St. ....	"	East Line of Gordon Ave.
1	8 "	Main St. ....	East.	North Line of Center St.
1	8 "	Payne Av. ....	North	East Line of Case Ave.
1	8 "	Water St. ....	East.	North Line of St. Clair St.
1	8 "	Water St. ....	"	South Line of St. Clair St.
1	8 "	Water St. ....	"	North Line of Frankfort St.
9	.....			
1	6 inch	Bridge St. ....	South	East Line of Waverly St.
1	6 "	Birch St. ....	East.	North Line of Franklin St.
1	6 "	Belmont St. ....	"	South Line of Orange St.
1	6 "	Courtland St. ....	North	South Line of Bridge St.
1	6 "	Chatham St. ....	"	West Line of Willett St.
1	6 "	Chatham St. ....	"	East Line of Mechanic St.
1	6 "	Chatham St. ....	"	East Line of Penn St.
1	6 "	Chatham St. ....	"	West Line of Jersey St.
1	6 "	Chatham St. ....	"	West Line of Ward St.
1	6 "	Chatham St. ....	"	West Line of York St.
1	6 "	Chestnut St. ....	"	East Line of Erie St.
1	6 "	Chestnut St. ....	"	West Line of Murlison St.
1	6 "	Chestnut St. ....	"	East Line of Murlison St.
1	6 "	Chestnut St. ....	"	West Line of Dodge St.
1	6 "	Canal St. ....	South	East Line of Seneca St.
15	.....			

**SCHEDULE SHOWING THE NUMBER AND LOCATION OF STOP  
GATES SET IN 1879—Continued.**

NO.	SIZE.	STREET	SIDE.	LINE OF STREET.
1.	6	Canal.....	South.	West line Seneca St.
1	6	Central Place.....	West.	North line Ohio St.
1	6	Ensign.....	North.	East line Willson Ave.
1	6	Forest.....	East.	North line Garden St.
1	6	Forest.....	"	South line Cedar St.
1	6	Florence.....	"	South line Quincy St.
1	6	Grant.....	"	North line Garden St.
1	6	Harmon.....	West.	South line Garden St.
1	6	Harper.....	East.	South line Garden St.
1	6	Harper.....	East.	North line Scovill Ave.
1	6	Hamilton.....	South.	East line Alabama St.
1	6	Hamilton.....	"	West line Sterling Ave.
1	6	King.....	"	East line Lawrence St.
1	6	King.....	"	West line Wason St.
1	6	Lyman.....	East.	South line Superior St.
1	6	Lyman.....	"	North line Payne Ave.
1	6	Lyman.....	"	South line Payne Ave.
1	6	Laurel.....	"	South line Garden St.
1	6	McHenry.....	"	South line Superior St.
1	6	McHenry.....	"	North line Payne Ave.
1	6	Merwin.....	"	South line Center St.
1	6	Merwin.....	"	South line German St.
1	6	Mechanic.....	"	South line Lorain St.
1	6	Mechanic.....	"	North line Chatham St.
1	6	McLean.....	"	North line Chatham St.
1	6	McLean.....	"	North line Monroe St.

**SCHEDULE SHOWING SIZE, NUMBER AND LOCATION OF STOP  
GATES SET IN 1879—Continued.**

No.	SIZE.	STREET.	SIDE.	LINE OF STREET.
1	6	Ohio.....	South.	West line Central Place.
1	6	Putnam .....	East	South line Garden St.
1	6	Sterling .....	"	South line Cedar Ave.
1	6	" .....	"	North line Superior St.
1	6	" .....	"	South line Superior St.
1	6	" .....	"	North line Payne Ave.
1	6	" .....	"	South line Scovill Ave.
1	6	Seelye .....	"	South line Woodland Ave.
1	6	" .....	"	At third hydrant south of Woodland.
1	6	" .....	"	North line Julia St.
1	6	Scovill .....	North.	East line Willson Ave.
1	6	Scovill .....	"	West line Slater Ave.
1	6	Seneca .....	East.	South line Michigan St.
1	6	Spring.....	"	North line St. Clair St.
1	6	Willett.....	"	North line Chatbam St.
1	6	Willcutt.....	"	North line Beaver St.
1	6	White .....	South.	West line Baker St.
1	6	Ward .....	East.	North line Chatham St.
1	6	Water.....	.....	41½ W. of E. L. Water & 1½ N. Frank't
2	6	For Hydrants.		
62				

**SCHEDULE SHOWING SIZE, NUMBER AND LOCATION OF STOP  
GATES SET IN 1879—Continued.**

<b>No.</b>	<b>SIZE.</b>	<b>STREETS.</b>	<b>SIDE.</b>	<b>LINE OF STREET.</b>
1	4	Bond.....	West.	North line Lake St.
1	4	French.....	South.	West line Columbus St.
1	4	Griswold.....	South.	East line Kinsman St.
1	4	Huntington.....	East.	North line Euclid Ave.
1	4	Huntington.....	East.	South line Payne Ave
1	4	Harmon.....	West.	North line Superior St.
88	4	For hydrants.		
94				
1	3	North Place.....	East.	North line Garden St.

## RECAPITULATION OF STOP GATES FOR 1879.

	36	30	24	20	16	12	10	8	6	4	3
Water Way in inches.....											
Set previous to 1879.....	1	14	7	14	19	15	90	153	520	865	200
Set during 1879.....								9	62	94	1
Total.....	1	14	7	14	19	15	90	161	582	959	201
Taken up during 1879.....										10	4
Total.....	1	14	7	14	19	15	90	161	583	949	205

## SCHEDULE SHOWING THE LOCATION OF FIRE HYDRANTS SET IN 1879.

NO.	SIZE.	STREET.	FEET	LOCATION.	SIDE.
C 13 to 4		Broadway.....		At Jefferson Street .....	West.
1 4		Bridge St.....		West Line of Waverly.....	South.
1 4		Birch St.....	238	N. of Franklin Avenue .....	East.
1 4		Belmont St .....	248	S. of Orange Street.....	East.
1 4		Bond St.....	19	N. of S. L. Summit.....	West.
1 4		Clark Ave .....	96	E. of Selden Street.....	South.
1 4		Clark Ave.....	12	E. of Guage Street.....	"
1 4		Clark Ave.....	35	E. of Milford Street .....	"
1 4		Clark Ave.....		At Ash Street.....	"
1 4		Carter St.....	233	S. of angle of Abutment of R. R. Bridge over Carter..	West.
1 4		Carter St.....	246	N. of S. L. Girard St .....	East.
C. 13 to 4		Center St .....		At Main Street.....	North.
1 4		Chatham St .....	117	E. of Mechanic.....	"
1 4		Chatham St.....		On W. Line of Jersey .....	"
1 4		Chestnut St.....	155	E. of Mulrson Street.....	"
1 4		Chestnut St.....	521	E. of Mulrson Street.....	"
1 4		Chestnut St.....	508	W. of Dodge Street.....	"
1 4		Chestnut St.....	94	W. of Dodge Street .....	"
1 4		Canal St.....		On W. Line of Seneca Street..	South.
1 4		Central Place.....	26	S. of Eagle Street.....	West.
1 4		Curtiss Ave .....	248	E. of Willson Avenue.....	South.
1 4		Cherry St.....	230	E. of Perry.....	"
C. 13 to 4		Elm St .....		At Spruce Street.....	North.
1 4		Ensign St.....	319	E. of Willson Avenue.....	"
1 4		Forest St.....	257	S. of Cedar Avenue .....	East
1 4		Forest St.....	322	322 N. of Garden Street..	"
1 4		Florence St.....	379	S. of Quincy Street.....	"
1 4		Grant St.....	354	S. of Cedar Avenue .....	"
1 4		Grant St.....	330	N. of Garden Street.....	"
1 4		Griswold St.....	372	E. of Kisman Street.....	North.
1 4		Harper St.....	177	N. of Scovill Avenue.....	East.
1 4		Harper St.....	490	S. of Garden Street .....	"

## SCHEDULE SHOWING THE LOCATION OF FIRE HYDRANTS SET IN 1879.

*Continued.*

NO.	SIZE.	STREET.	FEET	LOCATION.	SIDE.
1	4	Harper St. ....	160	S. of Garden Street ....	East.
1	4	Hamilton St. ....	318	E. of Alabama St. ....	South.
1	4	Huntington St. ....	188	N. of Euclid Avenue. ....	East.
1	4	Judd St. ....		At Harmon Street. ....	South.
1	4	King St. ....	378	E. of Lawrence Street ....	"
1	4	King St. ....	157	W. of Wasson Street. ....	"
1	4	Lorain St. ....		At E. Line of Gordon Avenue.	North.
1	4	Lorain St. ....	330	W. of Alum Street ....	"
1	4	Lorain St. ....		At Alum Street. ....	"
1	4	Lorain St. ....		At Purdy Street. ....	"
1	4	Lexington Ave. ....	317	E. of Willson Avenue. ....	South.
1	4	Lexington Ave. ....	710	E. of Willson Avenue. ....	"
1	4	Lexington Ave. ....	1196	E. of Willson Avenue. ....	"
1	4	Lyman St. ....	190	S. of Superior Street. ....	East.
1	4	Lyman St. ....	578	S. of Superior Street. ....	"
1	4	Lyman St. ....	409	N. of Payne Avenue ....	"
1	4	Lyman St. ....	3	N. of Payne Avenue. ....	"
1	4	Lyman St. ....	260	S. of Payne Avenue. ....	"
1	4	Lyman St. ....	570	S. of Payne Avenue ....	"
1	4	Laurel St. ....		At Garden Street. ....	"
1	4	Laurel St. ....	460	S. of Garden Street. ....	"
C. 14 to 6		Michigan St. ....		At Seneca Street ....	South.
1	4	McHenry St. ....	282	South of Superior Street. ....	East.
1	4	McHenry St. ....	670	South of Superior Street. ....	"
1	4	McHenry St. ....	317	N. of Payne Avenue. ....	"
1	4	Mechanic St. ....	8	South of Lorain Street. ....	"
1	4	Mechanic St. ....	246	N. of Chatham Street. ....	"
1	4	McLean St. ....		At Lorain Street. ....	"
1	4	McLean St. ....	140	N. of Chatham Street ..	"
1	4	McLean St. ....	179	S. of Chatham Street. ....	"
C. 13 to 4		Merwin St. ....		At Leonard Street. ....	"
C. 13 to 4		Merwin St. ....		At German Street. ....	"
1	4	Merchant Avenue. ....	378	N. of Fairfield Street. ....	West.

## SCHEDULE SHOWING THE LOCATION OF FIRE HYDRANTS SET IN 1879.

*Continued.*

NO.	SIZE.	STREET.	FEET.	LOCATION.	SIDE.
1	4	Slater Avenue.....	408	At Griswold Street.....	East.
1	4	Slater Avenue.....		S. of Griswold Street.....	"
1	4	Sterling Avenue.....	4	At Pine Street.....	"
1	4	Sterling Avenue.....		S. of Sonora Street.....	"
1	4	Sterling Avenue.....	206	S. of Superior Street.....	"
1	4	Sterling Avenue.....	346	N. of Payne Avenue.....	"
1	4	Sterling Avenue.....	2	N. of Payne Avenue.....	"
1	4	Sterling Avenue.....	151	S. of Scovill Avenue.....	"
1	4	Sterling Avenue.....	495	S. of Scovill Avenue.....	"
1	4	Sterling Avenue.....	196	N. of Woodland Avenue.....	"
1	4	Seelye Avenue.....	130	S. of Woodland Avenue.....	"
1	4	Seelye Avenue.....	506	S. of Woodland Avenue.....	"
1	4	Seelye Avenue.....	906	S. of Woodland Avenue.....	"
1	4	Seelye Avenue.....	619	N. of Julia Street.....	"
1	4	Seelye Avenue.....	215	N. of Julia Street.....	"
1	4	Scovill Avenue.....	237	E. of Willson Avenue.....	North.
1	4	Scovill Avenue.....	345	W. of Slater Avenue.....	"
1	4	Scovill Avenue.....		At Slater Avenue.....	"
1	4	St. Paul.....		At Washington Street.....	East.
1	4	Spring Street.....	5	N. St. Clair St.....	"
1	4	Spring Street.....	370	N. of St. Clair St.....	West.
1	6	Water Street.....		At Frankfort St.....	East.
1	4	Willcutt Street.....	357	S. of Woodland Avenue.....	"
1	4	Willcutt Street.....	3	At Beaver Street.....	"
1	4	White Street.....		At Baker Street.....	South.
1	4	Winter Street.....		At French Street.....	
91	.....	Total.			



## HYDRANTS CHANGED IN 1879.

NO.	TAKEN UP.	SET.	STREET.	LOCATION.	
1	3	4	Center St .....	Main street .....	North.
1	3	4	Elm St. ....	Spruce street .....	North.
1	4	6	Michigan .....	Seneca street.....	South.
1	3	4	Broadway. ....	Jefferson street.....	West.
1	3	4	Merwin St. ....	Leonard street....	East.
1	3	4	Merwin St.....	German street.....	East.
6					

TWENTY-FIFTH

ANNUAL REPORT

OF THE

BOARD OF

TRUSTEES OF WATER WORKS

TO THE

*CITY COUNCIL,*

TOGETHER WITH THE

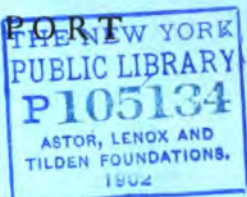
REPORTS OF THE OFFICERS OF THE BOARD

For the Year 1880.

CLEVELAND, O.:

HOME COMPANION PUBLISHING CO.

1881.



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PRESENTED BY

TWENTY-FIFTH

# ANNUAL REPORT

OF THE

*BOARD*

OF

# TRUSTEES OF WATER WORKS

TO THE

*CITY COUNCIL,*

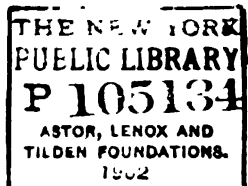
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For the Year 1880.

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CLEVELAND, O:  
HOME COMPANION PUBLISHING CO.,  
1881.



# REPORT OF TRUSTEES OF WATER WORKS.

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*To the Honorable Mayor and Council of the City of Cleveland :*

GENTLEMEN :—In compliance with law we submit to you the report of this department for the year 1880, it being the Twenty-fifth (25) Annual Report.

The gross receipts for water as shown by the report of the Secretary, are \$202,379 92, being an increase over the previous year of \$20,204 59 making the increase of net income \$20,088 90.

The amount expended for the extension of the pipe system is \$99,670 72, a large proportion of which was for the cost of laying a 30 inch main pipe from the pumping works to the intersection of Superior and Water streets, and also through Monumental Park. Though it may be necessary the coming season to continue the same from Water street to the Park, it is hoped that after providing from the earnings of the department for the further cost of a new boiler house, boilers and pumping engine, now partially contracted for as stated hereafter, a surplus of funds will remain sufficient to lay all the distributing pipe that the interests of the city may demand.

Contracts were made with H. P. Card for different qualities of coal for use at the pumping works for \$1.48 and \$1.65 per ton delivered on cars in the engine house lot. Contracts were also made with P. Smith and Geo. M. Smith for new boiler-house foundations ; with the Variety Iron Works for new boilers, and with H. R. Worthington for a pumping engine. Proposals will soon be invited for the superstructure of a new boiler house.

We have been able to meet all payments thus far for the enlargement of the pumping and delivery capacity of the works as set forth in our last annual report, from the surplus earnings of the department, and have reason to hope that, on account of delays in letting contracts and increased revenue, we shall be able to meet all payments for the work yet to be done without increasing the bonded debt of the city.

The number of service pipes that have frozen during the present winter has been unprecedentedly large in those streets in which pipe was laid during the earlier years of the works, but we are pleased to state that few such cases have occurred in streets in which pipe has been laid in recent years, and only then in cases where streets have been graded. It is our purpose during the coming season to cause all old pipes not deep enough to be safe against frost, to be lowered to such depth as experience has taught us will be safe. But while we may make the mains secure, we have no authority to compel the owners to lower their services, and if that precaution is neglected the same difficulty we have just experienced may be repeated during any cold winter hereafter.

With the improvements now in progress at the pumping works, which will eventuate in lowering the pump wells for the Cornish engines we fear no restriction to the passage of water through the tunnel, by obstruction of ice at the inlets of the crib, that will in any wise be serious.

With the large increase of population as shown by the late census, and increase of water consumption by manufacturers and general takers, we feel that a comprehensive and wise provision should be made for the future, and if a large draught is made in the near future on the income from this department to anticipate the wants of a prosperous and growing city, it will be but a judicious economy.

The historical diagram as prepared by the Superintendent will give you at a glance the probable future that must be provided for. While we realize that the strictest economy should be adhered to, and that this department should do all in its

power to lessen the burden of debt of our city (we feel this incumbent in order to prolong and make permanent our prosperity as a city) yet so vital is the supply of water that we should keep in advance of the demand far enough to ensure a good supply to all.

We appreciate the efficient alertness of those in direct charge of the works, and ask your careful scrutiny of facts and details as compiled by them. We shall put into practical operation whatever seems to be wise and judicious of their intimations.

We have changed the tariff for sprinkling streets and practically given to the citizens the water free of charge, only charging a small fee of twenty-five (25) dollars for each and every sprinkling cart or wagon for the season, making a reduction of seventy per cent.

All of which is respectfully submitted,

TRUMAN DUNHAM,	}	<i>Trustees of Water Works.</i>
S. W. SESSIONS,		
WM. H. LUTTON,		

*Cleveland, March 5, 1881.*





# REPORT OF SECRETARY.

*To the Trustees of Water Works:*

I hereby respectfully submit my report as Secretary, for the year 1880.

The receipts for water including permits, less	
amount refunded is	\$202,377 92
The net amount of expenses and repairs is	55,914 89

Leaving the net earnings	\$146,463 03
--------------------------	--------------

The comparative amounts with the previous year are :

Increase of receipts for water	\$20,204 59
Increase of expenses and repairs	115 69

Increase of net earnings	\$20,088 90
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The receipts and disbursements for the year and cash balances as shown by the books of this office are as follows :

## RECEIPTS.

For water from assessments.....	\$124,733 83	
For water by meter measure.....	75,963 25	
For permits (in water rent account).....	2,061 00	\$202,758 08
On construction account.....	598 12	
On pipe extension account.....	795 75	
On water meter account.....	477 86	
On office and general expense account.....	16 54	
On general repairs account.....	336 32	
On expense account, engine house.....	11 70	2,236 20
Cash in office at last annual report.....	751 91	
Cash in City treasury at last annual report.....	47,747 32	48,499 23
		\$253,493 00

## DISBURSEMENTS.

For pipe extension.....	\$100,466 47	
" interest on water bonds.....	40,000 00	
" returned water rent.....	380 16	\$140,846 53
" office and general expenses.....	20,527 12	
" general repairs.....	8,368 71	
" expenses at engine house.....	27,119 88	
" repairs at engine house.....	213 74	56,259 45
" payments on contract for boilers.....	7,619 23	
"         "         "         " boiler house.....	4,890 36	
" water meters.....	2,962 08	
On construction account.....	347 54	
On lake tunnel crib account.....	20 00	15,839 16
Cash in office Jan. 1st, 1881.....	802 69	
Cash in City treasury, subject to draft, Jan. 1881.....	39,745 67	40,548 36
		\$253,493 60

The receipts other than those embraced in water rent and permit accounts are from :

Jan.	C C C & I R'y Co. for repairing hydrant.....	\$ 13 78
	Malleable Iron Works for making connection.....	32 10
	Globe Iron Works for scrap iron 3845 lb, \$25.00 per ton.....	480 18
	Globe Iron Works for scrap iron, 11,794lb \$12 50 per ton.....	117 94
Feb.	S. Wood & Sons for repairing pipe.....	6 43
	J. J. Blatt.....	1 20
	C & P R'y for repairing pipe.....	47 31
March	J. O'Donald for 970 lb scrap iron.....	9 70
	H. J. Ready for 3 elevator connections.....	296 16
	D. M. Osborne for making elevator connection.....	67 75
	H. J. Ready for making two elevator connections.....	108 51
April	Valley R'y Co. for making connection.....	75 00
	Murphy & Co. for making connection.....	\$ 23 06
May.	J. Chatterton for scrap.....	4 46
	J. Farnan's estate for 3073 lb. old brass, a 15½ cts.....	476 39
	"         "         " 27½ " old lead.....	1 37
	"         "         " 20 " old iron, at ½c.....	10
	S. Woods & Son, connection for Cleveland Baking Co.....	60 10

# REPORT OF TRUSTEES OF WATER WORKS.

9

June.	F. A. Wadsworth for changing connection.....	20 08
	"    "    repairing pipe.....	7 50
July.	C. Hoyt for repairing stop cock.....	4 40
	Wadsworth & Roberts for labor.....	2 00
Aug.	Cemetery Trustees for making connection .....	44 04
	A. & G. W. R'y for repairing pipe.....	5 50
	Coe, Ely & Harmon for making connection .....	37 06
	Valley R'y, repairing valve.....	10 50
Sept.	J. H. Devereux and others for connection.....	98 62
Oct.	Valley R'y Co. for valve.....	12 30
	A. F. & H. Strator for making connection.....	34 20
	H. Gilbert for old cement pipe.....	1 50
Nov.	A. J. Aiken for scrap sold .....	1 53
Dec.	Brush Electric Co. for making connection.....	48 20
	H. J. Ready for making connection .....	85 51
	H. C. Spooner for old cement pipe.....	1 00
	Warrants on City treasurer cancelled before payment. ....	5 82
		<u>\$2,236 29</u>

## LEDGER BALANCES JANUARY 1, 1881.

FACE OF LEDGER.	DEBIT.	CREDIT.
Construction.....	\$2,628,319 24	
Interest.....	121,984 59	
New boiler.....	7,619 23	
New boiler house foundations.....	4,890 36	
Water meters.....	17,152 34	
City treasurer.....	39,745 67	
Cash.....	802 69	
Water rent income.....		\$1,047,442 86
Bonds outstanding.....		1,200,000 00
Bonds redeemed .....		526,000 00
City of Cleveland.....		48,071 26
	<u>\$2,820,514 12</u>	<u>\$2,820,514 12</u>

## BONDS.

Seventy five thousand dollars of Water bonds due October 1, 1880, was paid from the Sinking Fund provided for that purpose, leaving outstanding twelve hundred thousand dollars. Four hundred thousand dollars of which are to be paid from the above fund. No provision has been made for the payment of the balance.

H. C. HAWKINS,

*Secretary.*

Cleveland, March 5, 1881.

# REPORT OF THE SUPERINTENDENT AND ENGINEER.

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*To the Board of Trustees of Water Works—*

GENTLEMEN :—I herewith submit the twenty-fifth annual report upon the condition of the Water Works.

## LAKE CRIB.

I am enabled to report that no material change has taken place in this structure during the year just closed.

During the night of December 28th, broken ice lodged against the south-west side of the crib in such quantities that it rested upon the bottom of the lake, and raised to a height of twelve feet above the surface, temporarily obstructing the flow of water to the inlet shaft. A strong westerly to south-westerly wind had been blowing for several days which had lowered the surface of the lake to such an extent that only enough water would flow to the Cornish pumps to keep one of them working at about half the usual speed. The night was intensely cold and the waste of water was greater than during any other day throughout the year. The result was that before the lake raised to its ordinary level, the water in the reservoir had fallen seven feet, and it became necessary to start up both engines in the south building, where, the pump wells and suction pipes being deeper, there was abundance of water. During the seven years that the tunnel has been in use there has never been any interruption to the flow of water until this winter, and while—judging from the experience of others and our own experience with the old aqueduct—we might antici-

pate temporary interruption from anchor ice, the closing of the inlets with block-ice was never anticipated. The blockade was of short duration, however, lasting only a few moments.

Nothing has been done, as yet, towards the permanent rebuilding of the superstructure, and the experience of the past two years strengthens the opinion entertained and expressed by many whose judgment should not be disregarded, that the safest material to use in rebuilding would be timber. I regard the opinion of one person with whom I have consulted on the subject, and who has had an experience similar to our own, as of great weight. He expressed to me his belief that the safest material to use in such a building, resting upon a foundation of any kind less rigid than rock, would be timber.

It has been suggested that a breakwater, extending around three sides, and distant about fifty feet from the building, would protect it so that masonry of any description might be used with safety. While that is true, it is also a fact that the original expense of building such a breakwater would be greater than the cost of rebuilding the crib with timber, and the renewal of the structure thereafter, as might be necessary, would be as expensive as the renewal of the crib superstructure itself, while no greater safety would be secured.

When the proper time arrives for final action, the different plans suggested should be thoroughly examined before any one of them is adopted; you will then, no doubt, select the one which, under all the circumstances, will be best.

#### TUNNEL.

With the exception of the brief interval mentioned in connection with the crib, the flow of water through the tunnel has been uninterrupted, and the quality equal to that of former years.

#### BUILDINGS AND MACHINERY.

No repairs have been made to either of the engine houses during the year. I would again call your attention to the

necessity of renewing the stairs leading to the top of the stand pipe ; they are badly worn and are unsightly in appearance. I would also recommend that the Cornish engines, and the interior sides of the walls and wood-work of the engine room be painted at the same time the east wing is being fitted, for the reception of the new Worthington engine.

A stairway and gallery has been built, giving access to the tower rooms in the south building.

The foundation for the new boiler house and chimney, commenced late in the fall, was not as nearly completed as was desired, owing, partly, to delay in the shipment of stone from the quarries, but principally on account of the early commencement of winter. The excavation, piling and timber work, and the masonry for the chimney foundation having been completed, the remaining work can be pushed forward rapidly as soon as work can be resumed in the spring, especially, as nearly all the material is now on the ground. The amount expended upon the work up to the close of the year was \$4,890 36.

The building is designed to accommodate, when fully completed, all of the boilers required for running the two Cornish engines and two other engines of ten million gallons capacity each. Only one-half of the building is being erected under the present contract, the other portion may be built whenever it becomes necessary in the future to add to the pumping capacity of the works.

The new pumping engine now being built by H. R. Worthington, of New York, is to be of ten million gallons capacity daily, and, by the terms of the contract, is to be completed by the first of April next ; but owing to the delays heretofore mentioned, the boilers cannot be set and inclosed in time to use the engine at so early a date. The contract price of this engine, including the foundation above the floor line, boiler feed-pump, and all steam and water pipes within the engine room, is \$38,500, no portion of which has yet become due.

Three boilers of Otis steel are being built by the Variety



Iron Works of this city, to be used in connection with the new engine, the contract price for which, exclusive of pipe and fittings, is \$14,875, upon which has been paid the sum of \$7,619 23. They will be completed by the time the foundations are ready to receive them.

#### RESERVOIR.

The reservoir has not required any repairs or attention other than the usual care bestowed upon the paths, the cutting of grass and the removal of weeds from the inner slopes above the water-line by the keeper.

The brick lining will, no doubt, require extensive repairs in the spring, as it is likely to be considerably damaged by the heavy ice already formed in the basins, which, while adhering to the brick work, raises and falls with the water and carries with it more or less brick-work every cold winter. Last winter being unusually mild no damage occurred.

The stairs, fences, walks and other parts of the grounds are in good order.

#### MAIN PIPES.

The 16 inch, wrought iron, cement lined main pipe in Franklin street hill, the breaking of which, one year ago, caused so much damage, has been re-laid with cast-iron pipe from Columbus street to the top of the hill, a distance of 1295 feet. There yet remains about 1600 feet of the same kind of pipe in the 16 inch line, 1050 feet of which is between the top of Franklin street hill and the west side of Franklin Circle, the remainder, 550 feet, is in Ohio street, between Broadway and Erie street. This should be re-laid with cast-iron pipe as soon as the finances of the department will permit.

The new 30 inch main leading from the pumping works to Water street, was completed and put in use early in November, since which time the pressure in the lower part of the City has been materially increased and made more uniform. We are now enabled to use both engines in the south building at the same time.

The intensely cold weather of the last week in December, when both of the large engines had to be kept running day and night, and during which time the draught of water (not legitimate consumption) from the pipes was greater than during any day in the hottest and dryest time in summer, demonstrated at an earlier day than was anticipated, the urgent necessity for this new main, without which the supply of water during that period would have been insufficient.

A 30 inch pipe was laid in Superior street, through Monumental Park, previous to the repaving of that thoroughfare. A connection was also made between this pipe and the old 20 inch main at the intersection of Superior and Ontario streets which, when the new main is extended from Water street to the Park, will serve as a new feeder to the old system of supply mains.

It is proposed, early in the coming summer, to take up and re-lay the stone pavement in Superior street between Water street and the Park ; while that work is being done, the new 30 inch main should be laid from its present terminus at Water street to that part of it now laid through the Park, a distance of 1350 feet. An extension of 100 feet on the east-erly side of the Park would give an additional connection with the 8 inch pipe in Superior street east of the Park, and thereby increase the feed to the 16 inch main in Erie street.

The length of the main pipe added during the year is as follows : 30 inch, 6886 feet ; 20 inch, 130 feet ; 16 inch, 41 feet.

#### DISTRIBUTING PIPE.

The extension of distributing pipe during the year was 3 miles and 3390 feet, making the total length now in use 115 miles and 474 feet. Adding main pipes above 12 inches in diameter, the total length is 125 miles and 3148 feet.

#### STOP-GATES.

Of stop-gates, 95 have been added, making the total number set, to the 31st day of December, 2205.

## FIRE HYDRANTS.

The total number of fire hydrants now in use is 998. Of this number 40 were added during the past year.

The accompanying tables give information in detail of the amount of work done as described above.

## SERVICE PIPES.

The new service pipes connections made during the year are as follows :

$\frac{5}{8}$ inch	-	-	-	-	-	649
$\frac{3}{4}$ "	-	-	-	-	-	9
$1\frac{1}{4}$ "	-	-	-	-	-	1
$1\frac{1}{2}$ "	-	-	-	-	-	1
2 "	-	-	-	-	-	15
3 "	-	-	-	-	-	1
4 "	-	-	-	-	-	13
						<hr/>
Total	-	-	-	-	-	689

The total number of service connections made to the 31st of December is as follows :

$\frac{5}{8}$ inch	-	-	-	-	-	10,864
$\frac{3}{4}$ "	-	-	-	-	-	393
1 "	-	-	-	-	-	108
$1\frac{1}{4}$ "	-	-	-	-	-	4
$1\frac{1}{2}$ "	-	-	-	-	-	22
2 "	-	-	-	-	-	84
$2\frac{1}{2}$ "	-	-	-	-	-	2
3 "	-	-	-	-	-	35
4 "	-	-	-	-	-	51
6 "	-	-	-	-	-	1
						<hr/>
Total of all sizes	-	-	-	-	-	11,564

There are 1551 service pipes not in use, many of which have been permanently abandoned.

The number in use on the last day of the year was 10,013 being an increase for the year of 728.

## METERS.

The number of meters added during the year was 44, and the total number now in use is 402. The number of each size and the kind of meter is as follows :

KIND OF METER.	$\frac{3}{4}$	1	$1\frac{1}{2}$	2	3	4	
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	
Worthington Piston.....	120	110	47	51	21	3	352
Fitts Rotary.....	3	2		1	2		8
Ball & Fitts, Piston.....	24	11	3				38
Crown Rotary.....	2	2					4
Total.....	149	125	50	52	53	3	402

There are also in use 42 elevators operated by water power, an increase for the year of 11.

The quantity of water measured by meters and hydraulic elevators was 645,416,662 gallons.

The small number of meters now in use, have served in the past to check a very large waste of water. In one case, discovered not long ago, a waste was going on amounting to 86,500 gallons per day, another one, equally great, was discovered in the same manner a short time before. in both cases the water passed off without coming to the surface, in one case going into a sewer, in the other into the sand on the lake shore. These leaks would not have been discovered had there been no meters on the service pipes. Cases similar to these are constantly coming to our notice, and I have no doubt that the small number of meters now in use serve to check the waste of at least one million gallons of water per day.

If the great waste of water that can go on through a very small outlet under pressure, was generally known. I think less would be wasted. Frequent trials, made in the basement under this office, with a maximum water pressure of about 27 pounds per square inch, resulted in filling a tank, holding 100 cubic feet, or 748 gallons, as follows :

1-16 inch, circular orifice, time filling, 20 hrs. 20 m.						
1.8	"	"	"	"	5	" 33 "
3-16	"	"	"	"	2	" 2 "
1-4	"	"	"	"	1	" 39 "
5-16	"	"	"	"	1	" 22 "
3-8	"	"	"	"	1	" 15 "
7 16	"	"	"	"	1	" 10 "
1-2	"	"	"	"	0	" 55 "
3-4	"	"	"	"	0	" 37 "

The pipe from which the water was drawn supplies a portion of the City Hall building, and the experiments were made while water was being used from it elsewhere, consequently the pressure was not uniform, the result however is of more value on that account, for the reason that the conditions under which the water was drawn were similar to those prevailing in most cases, where waste or leakage is going on.

The smallest of the discharges given above would waste 322,000 gallons of water per annum, anywhere in the city at the level mentioned, while an orifice  $\frac{1}{4}$  inch in diameter would discharge 1,191,360 gallons or nearly four times the quantity discharged from the small one in the same time.

I believe that a majority of the wasteful water takers would, if they could fully realize these statements, discontinue the practice, but the application of a meter seems to be the only way to bring them to a realizing sense of their wastefulness.

I would recommend the continuance of the application of meters in all cases where the supply is large, all cases where the use is intermittent or cannot be estimated with a reasonable degree of accuracy and in all cases where there is a persistent wastefulness.

#### DISTRIBUTION.

The total quantity of water pumped during the year was 3,725,683,021 gallons, an increase over the quantity pumped in

1879 of 270,411,040 gallons and a per diem increase of 712,963 gallons, the rate of increase for the year was, therefore, 7 82-100 per cent.

The cost of pumping each million gallons of water 100 feet high was \$4 64, in 1879 the cost was \$5 00. Every item of expenditure for the year, made for the pumping works, is included in this cost, and it will be seen that, notwithstanding an increase in the cost of coal since the first of July, of 35 cents per ton, there has been a reduction in the cost of pumping of 36 cents per million gallons

#### GENERAL.

The question of a water supply for the more elevated sections of the city, lying to the south and east, is one that must at no distant day be brought before you.

Before deciding upon any plan I would suggest that the question of increasing the water head of our present system be carefully considered. The necessity for a better pressure in the higher portions of the city, taking water from the present system, is becoming more apparent each year, especially as water is now being so extensively used as a motive power for elevators and other light machinery. In many of the older streets the head of water is less than 50 feet and during the summer season, when the use of water is greatest, it often fails to reach the second floors of modern buildings for weeks in succession. The present water head is 158 feet above the lake, but a large portion of the city is at an elevation of 80 feet to 110 feet above the lake, and during times of greatest use of water, does not receive a satisfactory supply. I would recommend that the head be increased to 180 feet or an addition of 22 feet to our present head, whenever steps are taken to supply water to the highest levels of the city. The district to be supplied by high service works, would be materially reduced in area by an increase of head in our present system, and as a matter of course the machinery would be of less capacity.

In connection with this plan, it would be necessary to build

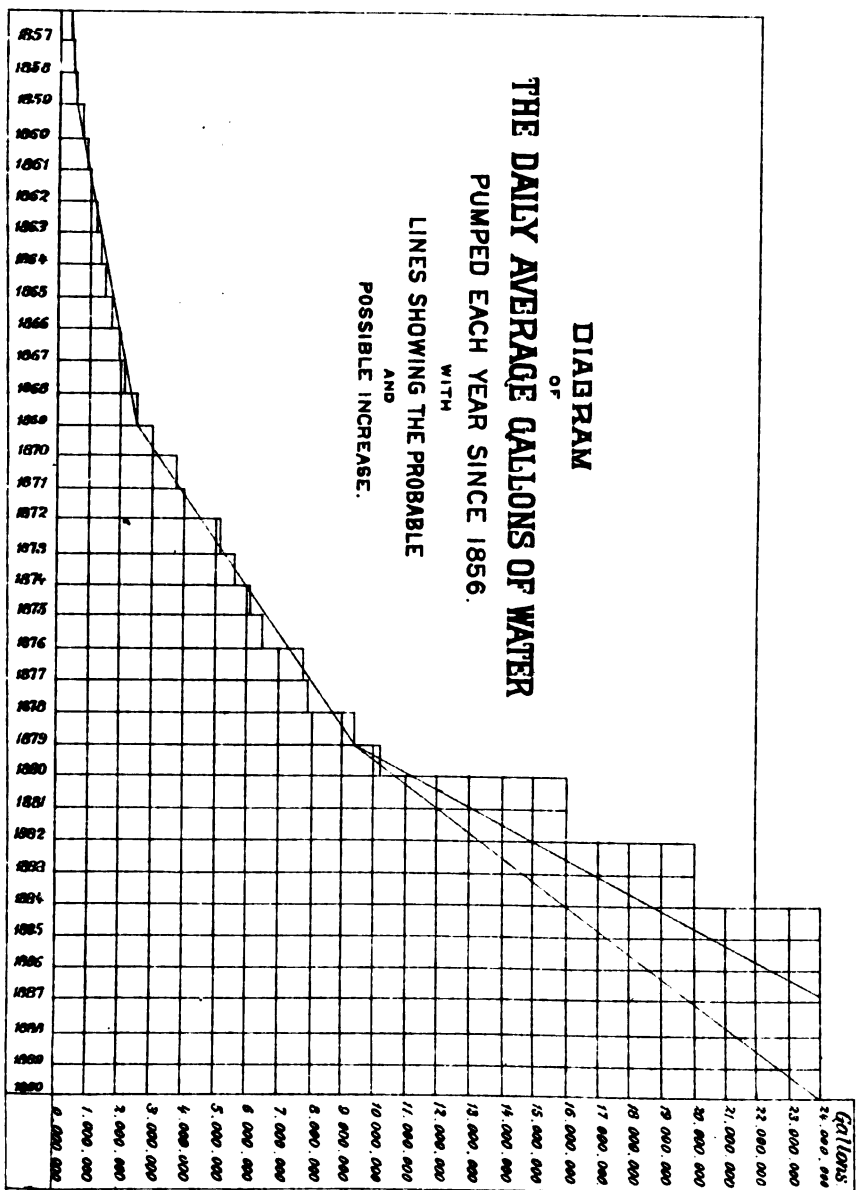
a new reservoir, which should be of large storage capacity and so located as to receive water from any new pumping works that may be built in the future, as has been suggested at some point east of the city. No changes would be required to adapt the machinery in the new pumping house to the increased head; it would only be necessary to carry a slightly increased steam pressure to enable the pumps to do the same work they are now doing. In the case of the old Cornish engines the stand pipe would have to be increased in height, and the pump plungers loaded to counterbalance the increased weight of the column of water. No other changes will be necessary. The street mains, with the exception of a few old lines of cement lined wrought iron pipe, that will have to be re-laid in any event, are of ample strength.

If these changes should be made, the abandonment of the present reservoir would of course follow, and that property could be sold for a sum that would go a long way towards paying the expense of such improvement. High service pumping works would be located upon and take water from the new low service reservoir.

In view of the rapid growth of Cleveland, and especially in the rapid increase in the use of water, it has been suggested that the time is not far distant when new pumping works, located on the lake shore, east of Willson avenue, will have to be built. Such works should pump water to about the same elevation I have already advocated, and would when built be only an enlargement of the system I have suggested. A diagram is herewith presented, showing the daily average and annual increase in the quantity of water pumped since the first year the works were in operation.

It will be seen by extending the averages of the past twenty years that in the year 1890, the average daily supply required will be about twenty-three million gallons, and may reach thirty million gallons, if the rate of increase of the past ten years be maintained for the ten years to come. If we

**DIAGRAM  
OF  
THE DAILY AVERAGE GALLONS OF WATER  
PUMPED EACH YEAR SINCE 1856.  
WITH  
LINES SHOWING THE PROBABLE  
AND  
POSSIBLE INCREASE.**







may judge from the experience of the present winter, the maximum demand will exceed the daily average by about ninety per cent., and that amount of surplus pumping power must be provided and ready for use at all times.

When the new pumping engine, now under contract, is completed, the total pumping power will be about thirty-eight million gallons, only one-half of which should be kept in constant service. As will be seen by the report of the engineer of pumping works, Mr. Doty, the Cornish engines cannot be depended on, in times of low water in the lake, to furnish any water, on account of the shallow depth of the pump wells, and as the quantity pumped by the other engines increases, the water gradually falls to lower levels, and even in times of ordinary stages of water these wells fail to receive enough to furnish the pumps.

The only safe remedy I can suggest is to build new pump wells outside of the building, and change the suction pipes so as to take water from them. This can be done in connection with the aqueduct that must be built to supply the new Worthington engines.

The low temperature, beginning in November, and continuing to this date, has caused the frost to penetrate the ground to a depth hitherto unknown in the history of the Water Works, and a greater number of service connections have frozen than during any winter since the works were built. This has been more noticeable in streets in which pipe was laid during, or shortly after, the construction of the works, when the practice was to lay all distributing pipes four and a half feet deep. For the last ten years, however, all such pipes have been laid five and a half and six feet deep. From none of these streets, excepting where grading has been done, subsequently, has there been any complaints.

I would recommend that all pipes, the services from which have been frozen, be lowered to a depth beyond the danger of frost in the future. In a few instances plumbers have found

frost over six feet in depth, but the general average up to this time appears to be, under stone pavements, about five feet.

During the very trying season of extreme cold, lasting almost continuously up to this time, every employe has felt the utmost solicitude for the safety and efficiency of the different parts of the works, and each one in any way connected with the care of the machinery, or the system of distribution, has performed his duty in a manner creditable to himself and satisfactory to the Superintendent.

Respectfully submitted,

JOHN WHITELOW,

*Superintendent and Engineer.*

Cleveland, February 15th, 1881.

REPORT OF THE  
ENGINEER IN CHARGE  
OF THE  
PUMPING WORKS.

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*To the Board of Trustees of Water Works :*

GENTLEMEN :—In reporting the condition of the Pumping Department of the Cleveland Water Works for the year 1880, I am able to say that nothing has seriously interrupted the constant supply of water in sufficient quantity to meet all demands upon us. This very desirable state of affairs can be attributed largely to the judicious forethought of your Superintendent in recommending to your honorable body the necessity of putting in the new 30-inch main recently completed. December 30th the water in the aqueduct fell so low that the Cornish engines could not be used, and we were obliged to run both engines in the south building. This could not have been done successfully without the new main. With this new main and the engine and boilers now under contract in place, our city will be in possession of pumping machinery sufficient for the next five years, with due allowance for increased consumption.

ENGINES.

The old Cornish engines are in good condition, considering the long and faithful services they have rendered, and with slight repairs, will continue to serve the city for many years. They are running every day and have done good service during the year, but the pump wells are so shallow that these engines cannot be depended upon at all times. This defect has long been known, but it becomes more apparent as additional pumps

are connected with the aqueduct, and some remedy should be applied at once, or serious accidents to these engines may occur.

The Henderson engines are held in reserve as usual, and are ready for service at all times.

The Worthington engines are our main dependence, as will be seen by reference to schedule farther on, giving quantities, etc.

Only slight repairs have been necessary upon any of the engines or pumps at the works the past year. Below please find a statement of the amount expended upon each engine, excepting the work done at the works by our regular force, the expense of which will appear in the Secretary's report of running expenses.

Amount of repairs on each engine for 1880 :

Worthington Duplex Engine,	-	-	\$236 80
Henderson       "       "	-	-	19 93
East Cornish       "	-	-	15 96
West       "       "	-	-	48 00

Schedule showing gallons of water pumped and coal consumed in pumping ; per centages of coal consumed and water pumped by the different engines ; contract price of coal, coal consumed and cost of raising 1,000,000 gallons into reservoir.

ENGINES.	Gallons Water Pumped by the Different Engines.	Pounds of Coal Consumed by the Different Engines.	Per ct. of Water Pumped by the Different Engines.	Per ct. of Coal Consumed by the Different Engines.	Pounds of Coal Consumed Pumping 1,000,000 Gallons Water into Reservoir.	Contract Price of Coal per Ton.	Cost of Raising 1,000,000 Gallons into Reservoir.	Year.
Worthington . . . . .	2,739,928,800	8,505,463	73.54	68.86	3104	\$1.65	\$2.56	1880
Henderson . . . . .	541,795,871	2,379,600	14.54	19.27	4391	"	3.63	"
Cornish . . . . .	443,958,350	1,465,900	11.92	11.87	3302	"	2.72	"

## BOILERS.

Twelve boilers have been in use during the past year, nine of which are in good condition. But the three old Cornish boilers in the east wing of the north building are condemned and will be removed very soon to give place to the new Worthington engines. Three boilers, removed from the south boiler house two years ago, are still laying in the north side yard, awaiting the construction of the new boiler house, when they will again be called into service.

Three new boilers, 10 feet diameter and 20 feet long, of the marine variety, are in course of construction at the Variety Iron Works, which are calculated to furnish steam for the new engines now under contract, and will be placed in the new boiler house on the north side.

No boiler repairs have been necessary since my last report, excepting a few rivets driven around the fire doors of the Connely boilers. All the boilers at the works are in good repair, excepting those mentioned as condemned.

## IMPROVEMENTS.

In connection with the plans for a new boiler house, provisions have been made for workshops. This improvement was very much needed since the works have reached their present magnitude. Minor repairs are almost constantly necessary, and the time spent in sending them away would in many cases be sufficient to do the work. I would, therefore, recommend, that when these shops are completed, they be supplied with such tools and machinery as will enable us to do the most of our repairs at the works.

In preparing the east boiler room for the reception of the new Worthington engines, some necessary improvements must be made to transform it from a boiler room to an engine room, and I would suggest that in connection with these improvements, the long neglected Cornish engines and engine rooms

receive such repairs and decorations as will make them more in keeping with the reputation of the works.

A gallery and stairway, leading to the two upper rooms in the northeast and northwest corners of the south building, has been completed in a neat and substantial manner, thus giving access to our drafting and store rooms. Besides, the gallery furnishes a good view of the machinery to visitors, an improvement very highly appreciated by us.

Our force of assistants at the works remains the same as at the time of my last report, and their continued service only strengthens my confidence in their ability to fill their respective positions and their desire to promote the interests of this department.

Reference to the following tables will give you a comprehensive synopsis of the work of 1880 as compared with former years.

Respectfully submitted,

R. DOTY,  
*Engineer in Charge.*

## TABULAR STATEMENTS.

The following pages contain tabular statements showing the work of engines, distribution of water, extension and laying of pipes, location and number of stop-gates and hydrants set, abstract of expenditures, &c,





## WORTHINGTON DUPLEX ENGINE RECORD FOR 1890.

MONTHS.	DAYS.	PUMPING.		COAL CONSUMED.			GALLONS OF WATER PUMPED.	HEIGHT IN FEET AND DECIMALS.	DUTY.
		Hours.	Minutes.	Strokes.	Raising Steam.	Pumping.	Total.		
January.....	31	744	.....	383,315	3,800	766,800	770,400	243,855,300	157.973 41,829,504
February.....	12	274	.....	168,647	4,200	318,200	322,400	102,701,140	158.055 42,110,861
March.....	31	744	.....	402,193	4,200	841,663	845,863	249,359,060	157.878 38,084,778
April.....	31	744	.....	453,989	3,800	858,500	862,300	281,028,780	157.725 42,997,918
May.....	24	559	20	358,428	.....	646,400	646,400	222,225,380	157.850 45,347,069
June.....	31	744	.....	461,527	3,000	818,100	821,100	288,146,740	157.656 45,955,549
August.....	31	743	30	482,774	6,900	850,700	857,600	299,319,880	157.825 46,076,990
September...	31	728	.....	452,171	3,800	862,700	866,500	280,346,020	158.070 42,779,217
October.....	21	488	.....	286,687	.....	567,200	567,200	177,745,940	158.438 41,531,223
November.....	30	719	.....	446,986	2,400	905,600	908,000	277,131,320	158.619 40,498,035
December.....	31	744	.....	516,243	8,800	1,069,800	1,078,600	320,070,660	158.975 39,461,342
Totals and Averages.	304	7,231	50	4,419,240	40,900	8,505,463	8,546,863	2,739,928,900	158.096 42,367,185

## HENDERSON DUPLEX ENGINE RECORD FOR 1890.

MONTHS.	DAYS.	PUMPING.			COAL CONSUMED.			GALLONS OF WATER PUMPED.	HEIGHT IN FEET AND DECIMALS.	DUTY.
		Hours	Minutes	Strokes.	Raising Steam.	Pumping.	Total.			
February .....	19	430	284,462	.....	.....	642,000	642,000	147,796,620	158 180	30,560,090
April .....	30	720	442,206	.....	4,200	1,024,000	1,030,200	226,760,084	157 814	30,327,267
June .....	7	162	102,423	.....	4,800	232,300	237,100	55,010,746	157 773	31,170,547
October .....	11	258	184,749	.....	5,400	452,100	457,500	97,553,141	158 091	28,316,304
December .....	8	115	10,606	.....	.....	28,000	28,000	5,675,280	159 694	27,419,551
Totals and Averages.	70	1,565	1,024,400	.....	14,400	2,279,000	2,394,000	641,796,871	158 810	29,556,769

CORNISH ENGINE RECORD FOR 1880.  
WEST ENGINE.

MONTHS.	PUMPING.		COAL CONSUMED.		GALLONS OF WATER PUMPED.	HEIGHT IN FEET AND DECIMALS.	DUTY.
	DAYS.	H M	Strokes.	Raising Steam.	Pumping.	Total.	
January .....	26	168	88,300	38,800	111,000	144,800	25,817,436
March .....	27	213	97,600	31,800	117,400	149,200	27,760,539
April .....	26	207	85,050	30,600	113,400	144,000	27,994,626
May .....	14	142	73,325	15,400	75,600	91,000	26,065,963
July .....	25	245	120,275	29,600	116,400	146,200	34,782,156
August .....	28	257	125,325	29,000	122,800	151,800	35,000,849
November .....	25	244	118,875	32,600	122,600	155,200	32,810,281
December .....	24	279	134,000	80,800	143,400	174,200	33,853,130
Total and Averages .....	183	1788	852,750	223,800	922,600	1,156,400	30,361,497

## CORNISH ENGINE RECORD FOR 1880—Continued.

## EAST ENGINE.

MONTHS.	DAY.	PUMPING.		COAL CONSUMED.		GALLONS OF WATER PUMPED.	HEIGHT IN FEET AND DECIMALS.	DUTY.
		Hrs.	Mins.	Raising Steam.	Pumping.			
February	24 189	20		27,000	99,800	29,716.575	158.141	23,107,588
May	12 118	40		17,800	55,000	18,144.525	157.848	32,631,916
June	26 207	50		33,600	132,000	42,171.375	157.170	33,471,951
September	26 246	25		30,400	120,400	38,553.950	158.089	31,758,802
October	26 254	25		29,000	115,200	35,622.975	158.508	32,745,857
December	2 34	45		2,400	20,200	6,069.900	159.874	35,897,709
Total and Averages	116 1101	25		140,200	543,300	170,229.300	158.272	31,925,686

CORNISH ENGINE RECORD FOR 1880 — *Concluded.*

## BOTH ENGINES.

ENGINES.	PUMPING.		COAL CONSUMED.		GALLONS OF WATER PUMPED.	HEIGHT IN FEET AND DECIMALS.	DUTY.
	Days.	Min. Hrs. Mins. Strokes.	Raising Steam.	Pumping.	Total.		
West engine .....	193 17 48	50	862,750	233,800	1,156,400	153,046	30,361,497
East engine .....	116 11 01	25	530,300	140,200	688,500	153,272	31,925,636
Total and Averages	309 28 49	15	1,393,050	374,000	1,839,000	153,159	31,143,566

## REPORT OF TRUSTEES OF WATER WORKS.

SCHEDULE SHOWING THE DISTRIBUTION OF WATER FOR EACH MONTH AND DAY IN THE YEAR 1880.

MONTHS.	Gallons of water pumped by Cor- pse engines.	Gallons of water pumped by Hen- derson engines.	Gallons of water pumped by Worthington engines.	GALLONS DISTRIBUTED.		
				Per month	Average per day.	Each inhab- itant per day.
January	28,344,380	•	243,855,380	272,198,600	8,790,622	58.22
February	29,710,575	147,706,620	102,701,140	280,214,385	9,062,508	61.94
March	31,280,680		249,359,680	280,680,200	9,054,402	58.04
April	30,511,050	235,700,064		266,271,134	8,875,704	58.83
May	41,681,850		281,028,780	322,708,630	10,408,065	68.73
June	42,171,375	55,010,746	222,225,380	319,407,481	10,646,916	68.24
July	38,048,275		286,146,740	324,755,015	10,475,068	67.15
August	40,220,225		299,310,880	339,540,205	10,953,200	70.21
September	38,503,050		290,346,020	318,849,970	10,628,332	68.13
October	35,622,975	97,553,141	177,745,940	310,922,050	10,029,743	64.23
November	33,158,175		277,131,320	315,289,495	10,509,649	67.38
December	49,080,800	5,077,280	220,070,680	374,828,840	12,091,188	77.50
Totals and Averages	443,053,330	511,707,871	2,730,924,800	3,725,683,021	10,179,461	65.25
						145.23

**SCHEDULE SHOWING THE TOTAL AND AVERAGE QUANTITIES OF  
WATER PUMPED EACH YEAR SINCE THE BEGINNING OF  
THE WORKS.**

YEARS.	GALLONS DISTRIBUTED.				Per cent. of increase.
	Per year.	Per day.	Each inhabitant per day.	Each consumer per day.	
1857 .....	127,262,265	348,664	7.75	110.68	
1858 .....	142,155,434	398,467	8.37	93.44	11.70
1859 .....	198,284,090	513,107	11.31	91.27	39.45
1860 .....	261,220,354	710,984	14.11	101.57	31.87
1861 .....	322,175,022	881,599	16.32	114.50	23.81
1862 .....	369,673,062	1,012,794	19.47	120.57	14.74
1863 .....	420,790,875	1,152,875	20.97	117.54	12.83
1864 .....	476,114,225	1,300,858	21.68	123.89	12.14
1865 .....	517,261,005	1,417,153	21.80	122.70	8.64
1866 .....	587,372,220	1,609,239	22.35	124.26	13.55
1867 .....	696,369,375	1,907,861	23.85	115.98	18.55
1868 .....	768,786,975	2,106,265	24.77	116.08	10.40
1869 .....	898,936,425	2,462,899	27.36	120.20	16.92
1870 .....	1,126,228,500	3,085,558	30.86	118.20	25.28
1871 .....	1,367,621,100	3,746,907	35.68	124.90	21.43
1872 .....	1,686,370,895	4,607,571	40.07	131.64	22.67
1873 .....	1,869,768,835	5,065,230	43.06	137.71	10.85
1874 .....	2,050,252,910	5,625,150	45.36	141.10	9.65
1875 .....	2,216,775,816	6,073,358	44.00	136.65	8.13
1876 .....	2,399,225,403	6,573,220	49.22	131.28	8.23
1877 .....	2,820,326,074	7,726,920	55.91	142.24	17.55
1878 .....	2,892,946,823	7,925,882	51.13	135.05	2.57
1879 .....	3,455,271,981	9,466,496	62.69	146.61	19.43
1880 .....	3,725,983,021	10,179,491	65.25	145.23	7.63



## REPORT OF TRUSTEES OF WATER WORKS.

SCHEDULE SHOWING THE EXTENSION OF PIPE IN 1890.

DIRE.	SIZE.	STREETS.	BETWEEN WHAT POINTS.	FEET LAID.	TOTAL.	REMARKS.
North	30	Division	From Y in Division st., 20 W. of E. L. Water Works lot north-westerly towards old pumping works...	70		
South	30	Division	From Y. just east of south pumping works to W. L. Pearl	2319		
East	30	Center	From W. curve at Center and Spruce sts. to W. curve at Center and Washington sta.	961		
West	30	Pearl	From W. L. Pearl to N. end of 30 in. curve at Pearl and Spruce.	116		
South	30	Spruce	From 30 in. curve in Pearl to first curve in Center st.	718		
South	30	Superior	From valve on Y 41 ft. W. of Merwin east to 56 feet east of Water st.	729		
South	30	Superior	From 16 feet W. of E. curb of Public Square at For- est City House, east to 10 feet E. of W. curb of Public Square near postoffice	513		
East	30	Washington	From N. curve at Washington and Center sts. to W. curve in West River st.	946		

SCHEDULE SHOWING THE EXTENSION OF PIPE IN 1890—Continued.

SIDE	SIZE.	STREETS.	BETWEEN WHAT POINTS.	FEET LAID.	TOTAL.	REMARKS.
South.....	30	West River.....	From W. curve in West River and Washington to 30 in. valve on Y near Vladuct.....	515	6886	
East.....	20	Ontario.....	Between 30 and 20 in. mains at Superior st.....	31		
West.....	20	Pearl.....	From 30 to 20 in. T in Pearl and Division sts., south.....	49		
West.....	20	Water.....	From 30 to 20 in. T in Water and Superior, north to 20 to 16 in. reducer 15 ft. S. of N. L. Superior.....	50	190	Relaid.
North.....	16	Franklin ave.....	From E. L. Columbus to valve at Russia st.....	1286		
West.....	16	Water.....	From 20 in. to 16 in. reducer 15 ft. S. of N. L. of Superior, north.....	41	1336	
North.....	12	Superior.....	Between 20 in and 8 in. mains in Water, near N. curb of Superior.....	21		
South.....	12	Main.....	From 30 in. to 12 in. T east to 16 ft. E. of Center st.....	29	50	
West.....	8	Columbus.....	From 26 ft. south of hydrant at Moore to N. L. Lorain st.....	160		
North.....	8	Lorain.....	From E. L. Gordon ave. to 94 W. of E. L. Chestnut Ridge st.....	1294		

SCHEDULE SHOWING THE EXTENSION OF PIPE IN 1880—Continued.

SIDE.	SIZE.	STREETS.	BETWEEN WHAT POINTS.	FEET LAID	TOTAL.	REMARKS.
North....	8	Main....	Between 12 in. and 8 in. pipes near E. L. Center st.	13		
South....	8	Main....	From E. L. Elm west to 10 ft. of E. L. Center st.	292		
East....	8	Madison ave....	From cross. in Quincy st. to T in Woodland ave....	1948		Relaid.
North....	8	Payne ave....	From cross. in Perry, east.	262		
South....	8	Quincy....	From 18 ft. E. of Ashland to cross. in Madison ave....	3157		
East....	8	Willson ave....	From hydrant at Julia st. to S. L. Bower st....	1008		
East....	8	Water....	From hyd. at Frankfort to 8 in. pipe in Superior st....	344	8838	
East....	6	Arlington....	From hyd 617 S. of Garden St....	505		
South....	6	Allen....	" T in Burnham to T in Parkman	616		
West....	6	Brookfield....	N. L. Euclid North	8		
East....	6	Case ave....	From T in Lake St. north.	312		
East....	6	Case ave....	" 212 S of St. Clair to cross in Superior St.	827		
South....	6	Canal....	" E. L. Seneca east.	5		
East....	6	Clifton....	" T in Payne Ave. to C. & P. R.	801		
South....	6	Diamond Park....	" T in Willson Ave. east to 6 ft east of Willson Av.	39		
West....	6	Elm....	" From cross in Main St. to 14 ft. W. of E. L. Wine- low St....	816		4 in. with 6 in. Relaid.

SCHEDULE SHOWING THE EXTENSION OF PIPE IN 1890—Continued.

SIZE	SIZE.	STREETS.	BETWEEN WHAT POINTS.	FEET LAID.	TOTAL.	REMARKS.
West..	6	Elm .....	From 14 W. of E. L. Winslow east. ....	24		
East.....	6	Lyman.....	" T in Mason north .....	307		
North.....	6	Lake .....	" T in Case ave. west to 18 ft. of W. L. Case .....	37		
East.....	6	Mechanic .....	" T in Chatham to Bailey st. ....	723		
South.....	6	Mason .....	" E L. Case ave. east to T in McHenry st. ....	672		
East.....	6	McHenry .....	" T in Mason st. north .....	186		
East.....	6	Newton.....	" T in Cedar to N. L. Garden st .....	762		
South.....	6	Platt.....	" 185 ft. E. of Carr st. to cross in Madison ave. ....	631		
East.....	6	Perry.....	" S. L. Superior to cross in Payne ave .....	699		
West.....	6	Petrie.....	" S. L. Broadway south.....	10		
West.....	6	Public Square .....	" 8 inch pipe in Superior south in front of Forest City House.....	194		
South.....	6	Prosser .....	From cross in Willson ave. east.....	61		
East.....	6	Sherbrook .....	" cross in Superior north.....	551		
	6	Solon .....	" T in Warren to T in Trumbull st .....	578		
South.....	6	Trumbull .....	" T in Forest to T in Solon st .....	396		
South.....	6	Walton ave. ....	" cross in Rhodes ave. west .....	33		

SCHEDULE SHOWING THE EXTENSION OF PIPE IN 1890—Concluded.

SIDE.	SIZE	STREETS.	BETWEEN WHAT POINTS.	FEET LAID.	TOTAL.	REMARKS.
North.....	6	Warren.....	" 10 ft. E. of Forest to T in Solon.....	382		
East.....	6	York.....	" cross in Carroll st. north.....	76	9731	
North.....	4	Aust.....	From T in Pearl to T in Hanover.....	615		
West.....	4	Clive.....	" T in Sibley to T in Cedar ave.....	343		
East.....	4	Duane.....	" S. L. Detroit St. south.....	8		
	4	Train.....	41 Hydrant connections.....	430	1376	
West.....	3	Hickox alley.....	From T in Prospect to N. L. Prospect.....	23	38	
					<u>23890</u>	

SCHEDULE OF PIPE TAKEN UP AND RELAID IN 1880.

DIAMETER OF PIPE TAKEN UP	DIAMETER OF PIPE RELAID.	STREETS.	BETWEEN WHAT POINTS.	FEET.	TOTAL.	REMARKS.
C. 16.....	16	Franklin ave.....	From E. L. Columbus to valve at Russia st....	1285		
C. 4.....	6	Elm.....	" " crosses in Main st. to 14 W. of E. L. Winslow st...	316		
C. 4.....	8	Main.....	" E. L. Elm west to 10 ft. of E. L. Center.....	292		
C. 18.....	8	Columbus.....	" 26 south of hydrant at Moore st. to N. L. Lorrain	190	2083	



SCHEDULE SHOWING SIZE, NUMBER AND LOCATION OF STOP  
GATES SET IN 1880.

NO	SIZE.	STREETS.	SIDE.	LINE OF STREET.
1	30 in.			20 feet east of South Pumping Works and 91 feet south of Division st.
	30 "	Division.....	North.	24 ft. W. of E. L. Water W'ks property and 27 ft., S. of N. L. Division st.
1	30 "	Division.....	South.	37 ft. E. of W. W. property and 34 ft. S. of N. L. Division st.....
1	30 "	Spruce.....	South.	W. L. Center st. and 18 ft. N. of S. L. Spruce st.
1	30 "	Superior.....	South.	6 ft. E. of Water st. and 37 N. of S. L. Superior st.
1	30 "	West River.....	East.	220 ft. N. of Myers and Osborn & Co's Cor. at Viaduct and River.
1	30 "	West River.....	East.	261 ft. N. of Myers and Osborn & Co.'s Corner at Viaduct & River.
7	30 in.	Total 30 in. valves.		
1	20 "	Pearl.....	West.	18 ft. E. of W. L. Pearl and 17 ft. N. of S. L. of Division st.
1	20 "	Ontario.....	East.	8 ft. N. of S. curb of Superior st. and 2 ft. E. of E curb of Ontario st.
1	20 "	Water.....	West.	33 ft. E. of W. L. Water st. and 42 S. of N. L. Superior st.
8	20 in.	Total 20 in. valves..		



**SCHEDULE SHOWING SIZE, NUMBER AND LOCATION OF STOP  
GATES SET IN 1880—Continued.**

No.	SIZE.	STREETS.	SIDE.	LINE OF STREET.
1	16 in.	Water .....	West.	N. L. Superior st. and 42 ft. E. of W. L. Water st.
1	16 in.	Total 16 in. valves.		
1	12 "	Division .....	South	25 ft. E. of W. W. property and 39 S. of N. L. of Division st.
1	12 "	Main .....	South	19 W. of E. L. Center and 22 N. of S. L. Main st.
1	12 "	Superior .....	North	49 ft. E. of W. L. Water st. and 19 S. of N. L. Superior st.
3	12 in.	Total 12 in. valves.		
1	8 "	Lorain .....	North	W. L. Gordon ave.
1	8 "	" .....	"	W. L. Higgins st.
1	8 "	" .....	"	E. L. Chestnut Ridge st.
1	8 "	Main .....	South	E. L. Elm st.
1	8 "	Madison ave. ....	East.	S. L. Quincy st.
1	8 "	" " .....	"	S. L. Platt s..
1	8 "	" " .....	"	N. L. Woodland ave.
1	8 "	Payne ave. ....	North	E. L. Perry st.
1	8 "	Quincy .....	South	E. L. Craw st.
1	8 "	" .....	"	E. L. Giddings ave.
1	8 "	" .....	"	E. L. Judson st.
1	8 "	" .....	"	W. L. Madison ave
1	8 "	Willson ave. ....	East.	S. L. Bower st.
1	8 "	Water .....	"	N. L. Superior st.
14	8 in.	Total 8 in. valves.		
1	6 "	Allen .....	South	W. L. Burnham st.
1	6 "	" .....	West.	S. L. Parkham st.

**SCHEDULE SHOWING SIZE, NUMBER AND LOCATION OF STOP  
GATES SET IN 1880—Concluded.**

NO.	SIZE.	STREETS.	SIDE.	LINE OF STREET.
1	6 in.	Case ave .....	East.	N. L. Superior st.
1	6 "	" .....	"	N. L. Lake st.
1	6 "	Clifton .....	"	N. L. Payne ave.
1	6 "	Diamond Park st. ....		E. L. Willson ave.
1	6 "	Elm. ....	West.	S. L. Winslow st.
1	6 "	Lyman ..	East.	N. L. Mason st.
1	6 "	Mechanic .....	"	N. L. Bailey st.
1	6 "	McHenry ..	"	N. L. Mason st.
1	6 "	Newton .....	"	S. L. Cedar ave.
1	6 "	" .....	"	N. L. Garden st.
1	6 "	Platt .....	South.	W. L. Madison ave.
1	6 "	Perry .....	East.	N. L. Payne ave.
1	6 "	Public Square .....	West.	S. L. Superior st.
1	6 "	Prosser ..	South.	E. L. Willson ave.
1	6 "	Sherbrook .....	East.	N. L. Superior st
1	6 "	Solon ..	West.	S. L. Trumbull st.
1	6 "	Trumbull ..	South.	E. L. Forest st
1	6 "	Walton ave. ....	"	W. L. Rhodes ave.
1	6 "	Warren .....	North.	W. L. Solon st.
1	6 "	York .....	East.	N. L. Carroll st.
22	6 in.	Total 6 in. valves.		
1	4 "	Aust .....	North.	W. L. Pearl st.
1	4 "	" .....	"	E. L. Hanover st.
1	4 "	Cleve .....	West.	S. L. Sibley st.
1	4 "	" .....	"	N. L. Cedar ave.
1	4 "	Public Square .....	"	102 S. of Superior st. and 31 ft. E. of W. line in front of Forest City House.
5	4 in.			
41	4 "	For fire hydrants.		
46	4 in.	Total 4 in. valves.		

## RECAPITULATION OF STOP GATES FOR 1880.

Water way in inches ...	36	30	24	20	16	12	10	8	6	4	3	
Set previous to 1880. ....	1	15	7	14	19	15	90	161	582	949	257	2110
Set in 1880.....		7		3	1	3		14	22	46		96
Total .....	1	22	7	17	20	18	90	175	604	995	257	2206
Taken out in 1880. ....											1	1
Total in use .....	1	22	7	17	20	18	90	175	604	995	256	2205

## SCHEDULE SHOWING LOCATION OF FIRE HYDRANTS SET IN 1880.

No.	SIZE.	STREETS.	FEET.	LOCATION.	SIDE.
1	4 in.	Aust .....	265	W. of Pearl .....	South.
1	4 "	Arlington .....	1122	S. of Garden .....	East.
1	4 "	Allen .....	278	W. of Burnham .....	South.
1	4 "	Cass ave. ....	271	N. of Superior st. ....	East.
1	4 "	" .....	346	S. of St. Clair .....	"
1	4 "	" .....	20	N. of S. L. of King st. ....	"
1	4 "	Clifton .....	355	N. of Payne ave. ....	"
1	4 "	" .....	765	" " " .....	West.
1	4 "	Elm .....	8	E. of Winslow st .....	South.
1	4 "	Lyman .....	125	N. of Mason st. ....	East.
1	4 "	Lorain .....	262	W. of Gordon ave. ....	North.
1	4 "	" .....	140	W. of Higgins st .....	"
1	4 "	" .....	300	E. of Chestnut Ridge st .....	"
1	4 "	" .....	94	W. of E. L. Chestnut Ridge st. ....	"
1	4 "	Madison .....	8	S. of N. L. Keys st. ....	East.
1	4 "	" .....	40	N. of Townsend st. ....	"
1	4 "	" .....		On N. L. Platt st .....	"
1	4 "	" .....	352	S. of Platt st .....	"
1	4 "	" .....	20	N. of Woodland ave. ....	"
1	4 "	Mechanic .....	279	S. of Chatham st .....	"
1	4 "	" .....		At N. L. Bailey st. ....	"
1	4 "	Mason .....	251	E. of Lyman .....	South.
1	4 "	Newton .....	14	N. of Garden st. ....	East.
1	4 "	" .....	372	S. of Cedar ave .....	"
1	4 "	Platt .....	344	W. of Madison ave. ....	South.
1	4 "	Perry .....	341	S. of Superior st .....	East.
1	4 "	Payne ave. ....		E. L. Perry st .....	North.
1	4 "	" .....	334	E. of Perry st .....	"
1	4 "	Quincy .....	29	W. of Baden ave. ....	South.
1	4 "	" .....	10	W. of Craw st. ....	"

SCHEDULE SHOWING THE LOCATION OF FIRE HYDRANTS SET  
IN 1890—Concluded.

No.	SIZE.	STREETS.	FEET.	LOCATION.	SIDE.
1	4 in.	Quincy .....	10	W. of E. L. Giddings ave.	South.
1	4 "	" .....	16	W. of Judson st.	"
1	4 "	" .....	7	W. of Lussenden st.	"
1	4 "	" .....	13	W. of Madison ave.	"
1	4 "	Sherbrook .....	507	N. of Superior st.	East.
1	4 "	" .....	224	" " "	"
1	4 "	Solon .....	214	S. of Trumbull st.	West.
1	4 "	Trumbull .....	87	W. of Solon st.	South.
1	4 "	Warren .....	4	" "	North.
1	4 "	Willson ave. ....	10	N. of Bower st.	East.
C 1	4 "	West River .....		At Myers & Osborns, changed from 3 in. to 4 in.	
41	4 in.	Set in 1880.			
968		Total hydrants in use Dec. 31, 1879.			
999		Total.			
1		Hydrant changed at Myers & Osborns.			
998		Total number of hydrants in use Dec. 31, 1880.			

## ABSTRACT OF EXPENDITURES.

## RECAPITULATION.

Pipe Extension .....	\$100,466 47
General Repairs.....	8,398 71
Office and General Expenses .....	20,527 12
Engine House Expenses .....	27,119 88
Engine House Repairs .....	213 74
Lake Crib .....	20 00
Water Meters.....	2,962 03
New Boiler House Foundation .....	4,890 36
New Engines and Boilers .....	7,619 28
Construction.....	347 54
Total .....	<hr/> \$172,565 08

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